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Advances in Medicine, Psychology and Public Health (AMPPH)

Editor's Page

The *"International Network for the Advancement of Medicine, Psychology, and Public Health"*: Pioneering progress in medicine and social development

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Dear Readers,

As we navigate the complex challenges of our times, the *"International Network for the Advancement of Medicine, Psychology, and Public Health"* stands as a beacon of hope and collaboration. Our journey with the newly launched "*Advances in Medicine, Psychology, and Public Health*" is a testament to the power of collective scientific effort and international cooperation.

This Network, a culmination of global scientific unity, has made significant strides. The "*Journal of Health and Social Sciences*," a shining example of our collaborative success, has been recognized and indexed on Scopus. Similarly, the "*Italian Journal of Psychology and Occupational Health*," from the Italian Association of Psychology and Occupational Health, represents another vital contribution to our expanding portfolio of influential scientific journals.

Our world faces unprecedented environmental, societal, and health challenges.

In response, the Network fosters interdisciplinary dialogue and problem-solving, breaking geographical and cultural barriers.

Our collaborative research in medicine, psychology, and public health is more than an academic pursuit; it is a proactive approach to creating a more informed, empathetic, and united global community.

We envision a world where scientific cooperation informs political leadership, advocating peace, understanding, and ethical governance. The Network models how collaboration, rather than conflict, can lead to sustainable and positive global change.

Our endeavor is guided by the highest ethical and spiritual values in these challenging times. We believe that compassion and unity should underpin scientific exploration and societal advancement. Our initiative goes beyond scientific inquiry; it is a commitment to humanity's moral and ethical advancement.

We invite scientists, researchers, and institutions worldwide to join us in this vital endeavor.

Together, we can redefine the role of the global scientific community, championing knowledge, discovery, and, importantly, peace, equality, and sustainable development.

Sincerely,

Francesco Chirico, MD, Prof

Editor in Chief and Founder at Advances in Medicine, Psychology, and Public Health

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Advances in Medicine, Psychology and Public Health (AMPPH)

Original Article in Psychiatry

Animal-assisted therapy in patients affected by schizophrenia and schizophrenic-related disorders: A scoping review

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Abstract

Introduction: Schizophrenia poses significant challenges in psychiatric care. Amidst established practices such as pharmacological therapy and psychotherapy, Animal-assisted therapy (AAT) is gaining attention as a potential approach to enhance the psychophysical well-being of patients with schizophrenia. This scoping review aims to map the existing literature on the impact of AAT on schizophrenia, focusing on changes in symptoms and overall well-being of affected individuals and identifying potential areas for intervention and future research.
Methods: A systematic search was conducted from August to September 2023 using a scoping review methodology. The review encompassed international biomedical databases, including PubMed, Cinahl, PsycINFO, and Embase, and incorporated additional resources such as relevant textbooks and gray literature.
Results: The review highlights AAT as a promising co-therapeutic approach, demonstrating benefits across physical, mental, emotional, and social dimensions in schizophrenia patients. It is particularly noted for its potential in alleviating the disorder's negative symptoms.
Discussion and Conclusions: The findings of this scoping review suggest that AAT could play a significant role in treating and managing schizophrenia, enhancing patient well-being and treatment adherence. However, the review also reveals gaps in current research and emphasizes the need for further studies to establish a more robust evidence base. This would aid in better understanding the efficacy of AAT and in integrating it effectively into mental health care practices for schizophrenia.

Take-home message: Animal-assisted therapy seems to improve the psychological well-being of schizophrenic patients.

Keywords: animal-assisted therapy; review; schizophrenia; well-being.

INTRODUCTION

Animal Assisted Therapy (AAT) represents a novel, non-pharmacological approach to therapeutic interventions. Characterized by structured interactions between animals and patients, AAT aims to achieve specific therapeutic goals, contributing to rehabilitation and psychological well-being [1]. Maujean [2] emphasizes that animals play a pivotal role in these therapeutic processes, adapting to the varied settings, durations, and activities tailored to individual needs. Sessions can be conducted in diverse environments such as clinics, hospitals, nursing homes, and private settings, incorporating activities ranging from games to more direct animal care [3].

The Italian "Istituto Superiore di Sanità" recognizes AAT for its multifaceted impact on physical, neurological, cognitive, emotional, and relational disorders across a spectrum of pathologies [4]. This comprehensive approach necessitates a multidisciplinary team, including veterinary specialists, therapists, and healthcare professionals, to fully harness the therapeutic potential of the animal-patient relationship.

Distinct from general pet ownership, AAT involves more structured and goal-oriented activities, including animal-assisted activities (playing sports with animals under supervision) and more comprehensive animal-assisted interventions that blend AAT with health education programs. The latter has been noted to be highly effective, particularly in rehabilitation [5,6].

The applicability of AAT extends to a range of animals beyond the commonly used dogs, including horses (hippotherapy), cats, fish, dolphins, rabbits, and birds. This diversity allows AAT to cater to varied individual preferences and therapeutic needs [7]. However, despite its increasing popularity, the Efficacy of AAT, particularly in complex mental health conditions like schizophrenia, remains an area of ongoing research [8].

Schizophrenia, as defined by the World Health Organization (WHO), affects approximately 24 million people globally and manifests in a broad spectrum of symptoms, including delusions, hallucinations, thought and language disorders, and cognitive deficits. Schizophrenia and similar psychotic conditions manifest through three key symptom types: positive, negative, and cognitive impairments. Positive symptoms include hallucinations, delusions, and incoherent speech, whereas negative symptoms encompass lack of motivation, inability to experience pleasure, and emotional dullness. Factors such as genetic vulnerability, drug abuse, traumatic experiences, and intense stress contribute to the likelihood of developing a severe psychotic disorder [4]. The etiology of schizophrenia is complex, involving a mix of genetic and environmental factors, and often leads to significant challenges in treatment adherence and psychosocial functioning [9].

Conventional treatments for schizophrenia typically combine antipsychotic medications with psychotherapy, often cognitive-behavioral therapy [10]. However, the persistence of negative and cognitive symptoms has led to exploring additional co-therapeutic strategies like AAT to enhance overall treatment efficacy [1,11].

This scoping review, therefore, aims to assess the current evidence regarding the impact of AAT on the psychophysical well-being of individuals suffering from schizophrenia.

METHODS

Study design and procedure

This scoping review followed established guidelines for scoping reviews [12]. The aim was to explore the breadth and depth of literature on AAT in the treatment of schizophrenia. Scoping reviews are particularly suited for emerging research areas to map the existing literature and identify key concepts, sources, and gaps.

Search strategy

A comprehensive literature search was performed across several databases, including PubMed, Cinahl, PsycINFO, and Embase. The search strategy utilized a combination of keywords: "Animal Assisted Therapy," "schizophrenia," "pet therapy," "treatment effects," "animal-assisted service," "animal-assisted activity," and "dog." The search was conducted over two months, from August to September 2023.

Selection criteria

The inclusion and exclusion criteria were established to focus on relevant studies:

Inclusion criteria:

Articles published in English.

Studies involving children or adult subjects diagnosed with schizophrenia or schizophrenia-related disorders.

Research including AAT as an intervention.

Articles presenting primary data or reviews.

Exclusion criteria:

Studies not involving human participants.

Articles not available in full text.

Non-English language publications.

Studies regarding different psychological disturbances including schizophrenia or schizophrenia-related disorders.

Data charting and collection

Data were charted from each included study using a form designed for this review. Key information extracted included author(s), year of publication, country, study design, sample size, details of AAT interventions, measured outcomes, and main findings.

Analysis and presentation of data

The results were analyzed to map out the key themes, trends, and gaps in the literature. The findings were categorized and synthesized narratively, focusing on the characteristics of the studies, types of AAT interventions, outcomes, and overall conclusions drawn from the literature.

RESULTS

Our scoping review of AATs in the treatment of schizophrenia encompassed a diverse array of studies (n = 12), including 2 systematic reviews, 4 randomized controlled trials (RCTs), 1 cross-sectional study, 2 qualitative analyses, 2 pilot studies and 1 clinical trial. These studies collectively provided a comprehensive overview of the impact of various forms of AAT, such as equine-assisted interventions, dog-assisted therapies, and hippotherapy, on individuals diagnosed with schizophrenia and related disorders.

To provide a clearer understanding of the specific impacts of AAT on schizophrenia, Table 1 summarizes key studies in this area, highlighting their design, sample size, type of AAIs, and the main results.

Table 1. Summary of key studies on the efficacy of animal-assisted therapy in schizophrenia treatment.

Authors and year	Study Design	Type of AATs	Results
Barak et al. (2001) [13]	RCT	AAT was conducted in weekly 4-hour sessions. Subjects were 10 elderly schizophrenic patients and 10 matched patients (mean age: 79.1±6.7 years).	Treatment encouraged mobility, interpersonal contact, and communication and reinforced activities of daily living (ADLs), including personal hygiene and independent self-care, through the use of cats and dogs as "modeling companions." The Social Adaptive Functioning Evaluation (SAFE) scores increase in the group subjected to animal therapy: from p = 0.003 to p = 0.001.
Calvo et al. (2016) [14]	RCT	Twenty-two institutionalized patients with chronic schizophrenia completed the 6-month rehabilitation program, which included individual psychotherapy, group therapy, a functional program (intended to improve daily functioning), a community program (intended to facilitate community reintegration) and a family program.	At the end of the program, both groups (control and AAT-treatment) showed significant improvements in positive and overall symptomatology, as measured with the Positive and Negative Syndrome Scale PANSS, but only the AAT-treatment group showed a significant improvement in negative symptomatology. Cortisol level was significantly reduced after participating in an AAT session, which could indicate that interaction with the therapy dogs reduced stress.
Cerino et al. (2011) [15]	Clinical Trial	Twenty-four subjects with a diagnosis of schizophrenia were enrolled for a 1 year-treatment involving therapeutic riding sessions. All subjects were tested at the beginning and at the end of treatment with a series of validated test	The results reveal a persistent state of regression of the pathology with regards to negative symptoms, together with a decrease in hospitalization days. The pre-treatment BPRS value was 80.1, reduced to 57.1 for one patient (t = -4.663; p = < 0.005) and 69.1 for the rest of the group (t = -4.572; p = < 0.001) at the end of treatment. The PANSS reports a change from 33.3% to 25.9% at the end of treatment (t= - 5.032; p = <0.001).

		batteries (BPRS and 8 items-PANSS).	
Chen et al. (2022) [16]	RCT	Forty participants were randomly assigned to either the AAT or control group. The AAT group participated in one-hour sessions with dog-assisted group activities once a week for 12 weeks. The controls participated in dose-matched, non-animal-related recreational activities. Both groups remained on their usual psychotropic medication during the trial.	The AAT group showed a greater increase in lower extremity strength and social skills, but no improvement in cognitive function, agility, or mobility.
Corring et al. (2010) [7]	Qualitative study	A sample of 6 ACT patients with schizophrenia or schizoaffective disorder who reside in the community and 6 mental health care staff participated in 10 weeks of weekly horseback riding sessions with an experienced THBR instructor	THR was effective in patients with schizophrenia as they gained enjoyment, developed a relationship with the horse, learned new skills and increased their level of self-esteem.
Corring et al. (2013) [17]	Qualitative study	A sample of 6 ACT patients with schizophrenia or schizoaffective disorder who reside in the community and 6 mental health care staff participated in 10 weeks of weekly horseback riding sessions with an experienced THBR instructor.	The study shows that horseback riding is useful for patients suffering from schizophrenia, as they have fun, increase self-confidence and create a bond with the animal.
Jormfeldt et al (2018) [18]	Systematic review of 6 studies	Equine-assisted interventions among individuals diagnosed with schizophrenia	The findings of the six included articles indicate that therapeutic equine assisted interventions could be beneficial for individuals with severe mental illness such as schizophrenia or schizophrenia like disorders.
Kovacs et al. (2004) [19]	Pilot study	Weekly sessions of animal-assisted therapy for a nine-month period, each therapeutic session lasting for 50 minutes on 7 schizophrenic patients	After completion of therapy there were significant improvements in home and daily living activities.

		living in a social institution	
Lang et al. (2010) [20]	Cross-sectional study	Dog-assisted interviews in 14 acute schizophrenic patients	Anxiety, measured with the STAI in 14 was reduced after the interview with the presence of a dog when compared to the control interview situation (F=106.19; df =1; p< 0.0001),
Nathans-Barel et al. (2005) [21]	Pilot study	The hedonic tone of 10 chronic schizophrenia patients who participated in 10 weekly interactive sessions of AAT was compared to a control group treated without animal assistance.	The group subjected to AAT demonstrated a significant improvement in anhedonic tone compared to the control group (ANCOVA df = 1, 17, F= 6.30 p = 0.02).
Seredova et al. (2016) [22]	RCT	25 patients with paranoid schizophrenia, or acute and transient psychotic disorders attended 90 minutes hippotherapy sessions two days a week for a period of three weeks	Hippotherapy increased well-being (F = 7.81, P = 0.007) and the differences between the well-being scores before and after the treatments increased with treatment repetitions (F = 7.81, P = 0.007). The effect hippotherapy was statistically significant for all well-being characteristics except for tension in the first treatment and contact in the second treatment
Tyssedal et al. (2023) [11]	Systematic review of 12 RCTs and non-RCTS	Dog-assisted interventions for adults diagnosed with schizophrenia and related disorders.	General psychopathology, positive and negative symptoms of psychosis, anxiety, stress, self-esteem, self-determination, lower physical strength, social functioning, and quality of life were among the most significant outcome measures in terms of improvement.

The included studies collectively underscore the potential of AAT as a co-therapeutic approach for schizophrenia, contributing to improved psychosocial functioning and quality of life.

Tyssedal et al.'s review [11] of 12 RCTs and non-RCTs showed improvements in various aspects such as general psychopathology, positive and negative symptoms, anxiety, stress, self-esteem, and social functioning in adults diagnosed with schizophrenia. In this review, quality of evidence was graded low or very low for all outcome measures. Indeed, low number of participants, heterogeneity, and risk of bias complicate the interpretation of results.

Jormfeldt et al's [18] systematic review indicated that equine-assisted therapies could be beneficial for individuals with severe mental illnesses like schizophrenia, enhancing their overall well-being.

Studies like Corring et al.'s qualitative analyses [7,17] demonstrated that THR was effective in increasing self-esteem and developing new skills among patients with schizophrenia. Several studies, including those by Calvo et al. [14] and Chen et al [16], reported significant improvements in negative symptoms of schizophrenia and overall well-being following AAT sessions. AAT was found to increase social skills and physical strength among participants but showed varying results regarding cognitive functions and agility. Kovacs et al.'s pilot study [19] reported improvements in daily living activities among schizophrenic patients after AAT therapy. Nathans-Barel et al.'s [21] study demonstrated significant improvements in anhedonic tone, an important aspect of schizophrenia, through AAT. Cerino et al.'s [15] clinical trial indicated a regression in negative symptoms and a decrease in hospitalization days after a year-long treatment involving therapeutic riding sessions.

Seredova et al.'s RCT [22] showed that hippotherapy increased well-being in patients with paranoid schizophrenia, with repeated treatments enhancing the effect. Barak et al.'s RCT highlighted that AAT facilitated mobility, interpersonal contact, and reinforced activities of daily living, improving Social Adaptive Functioning Evaluation scores.

DISCUSSION

This scoping review mapped the current landscape of AAT in the treatment of schizophrenia, revealing diverse approaches and outcomes. The literature predominantly indicates a positive impact of AAT on schizophrenia, aligning with previous studies highlighting the benefits of AAT in various psychiatric conditions [23,24].

In literature, frequent interactions with animals, coupled with activities focused on self-care, have been shown to boost patients' self-esteem, leading to increased activity and responsibility in their personal affairs [25,26]. Another study highlighted progress in emotional symptoms and various facets of self-perception and self-image [27]. A critical aspect of this approach is its ability to yield tangible benefits in areas where conventional treatments may fall short. This is particularly evident in treating the symptom of anhedonia in patients, which significantly impacts their daily life quality [25].

In the 2022 study by Monfort et al. [28], a randomized controlled trial (RCT) was conducted where Animal-Assisted Therapy (AAT) was administered over a period of three months in patients affected by depression and schizophrenia. This therapy included a series of 10 sessions, held weekly, with each group comprising up to 10 patients. The study reported notable results, including a significant reduction in the positive symptoms of psychosis (F: 27.80, $p = 0.001$), as well as a marked improvement in patient functionality (F: 26.70, $p < 0.001$) as the therapy sessions progressed.

Engagement of patients with schizophrenia in animal therapy has shown beneficial effects on anhedonia, a symptom of the disorder characterized by a diminished ability to find pleasure in normally enjoyable activities and situations. In psychiatric institutions, the introduction of animal therapy programs for individuals with schizophrenia has become increasingly favored over other treatment approaches. Participation in these programs has been linked to a reduction in apathy and the lessening of negative symptoms associated with the condition.

Our scoping review of AAT in schizophrenia treatment revealed several key findings across a range of studies. AAT interventions, particularly dog-assisted therapies, showed significant improvements in the negative symptoms of schizophrenia, such as social withdrawal and apathy. Participants who underwent AAT exhibited reductions in general psychopathological symptoms. This included a decrease in both positive and negative symptoms of psychosis. Studies reported that AAT led to better social functioning and overall quality of life in schizophrenia patients, improving interpersonal communication and enhancing mobility. Notable reductions in stress and anxiety levels were observed following AAT sessions, with some studies, such as that by Calvo et al. [14], noting lowered cortisol levels, indicating reduced stress. AAT also had physical health benefits, such as increased lower extremity strength, particularly noted in patients engaging in dog-assisted group activities. Some studies highlighted improvements in daily living activities and self-care skills post-AAT, although enhancements in cognitive functions were not consistently reported. Emotional symptoms and hedonic tone improvements were evident in participants, indicating enhanced emotional well-being following AAT. AAT was generally well-received by patients, indicating a higher level of treatment adherence and acceptability compared to some traditional therapies.

The findings from this review suggest that AAT can be a valuable adjunct to conventional treatments for schizophrenia. The observed benefits in social functioning and symptom management highlight AAT's potential to complement pharmacotherapy and psychotherapy. This integration could particularly benefit patients who exhibit negative symptoms or have limited responsiveness to traditional treatments. However, it is crucial for clinicians to consider individual patient preferences and specific needs when integrating AAT into treatment plans. The choice of animal, the nature of activities, and the frequency of sessions should be tailored to each patient's unique condition and circumstances.

The International Association of Human-Animal Interaction Organizations (IAHAIO) has issued comprehensive guidelines for conducting animal-assisted interventions (AAI) [29]. These directives specify that AAIs should be purposeful and structured, aiming for therapeutic outcomes. Within the scope of AAI, AAT and animal-assisted activity (AAA) are two distinct forms relevant to healthcare. AAT is characterized by its planned, quantifiable, and recorded nature, while AAA involves more casual and informal interactions. The guidelines also clarify that AAT focuses on improving physical, cognitive, behavioral, and socio-emotional aspects, whereas AAA primarily enhances motivation, education, and recreational experiences.

The quality of studies on this topic varied, with some providing robust evidence through controlled methodologies, while others were qualitative or pilot studies with smaller sample sizes. This variation in study design and quality highlights the need for more rigorous research in this field. Standardized protocols and outcome measures would enhance the comparability and generalizability of future studies.

Despite the positive indications, there are significant gaps in the literature. There is a need for larger, long-term studies to ascertain the sustained effects of AAT and its impact on different stages and subtypes of schizophrenia. Future research should also explore the mechanisms underlying the observed benefits, such as neurobiological changes and psychosocial factors.

Additionally, the variability in AAT implementation across different settings calls for research on best practices and standardization in this therapy modality. Studies that compare different types of animals and intervention models would provide valuable insights into optimizing AAT for schizophrenia patients.

The inclusion of animals in therapy introduces unique ethical considerations. It is essential to ensure the welfare of the animals involved and to establish guidelines for their care and handling. Ethical considerations also extend to the patients, particularly in obtaining informed consent and ensuring that the therapy aligns with their preferences and beliefs.

This review has several limitations. Firstly, the exclusion of non-English language and gray literature studies, as well as mixed studies (AAT on patients affected by depression, schizophrenic, and other psychological disorders in the same intervention) may have omitted relevant findings. Secondly, the heterogeneity in study designs and outcomes makes it challenging to draw definitive conclusions. Finally, the scoping nature of this review limits the depth of analysis on specific aspects of AAT in schizophrenia.

CONCLUSION

The review found a variety of AAT interventions using different animals and settings, suggesting customizable approaches based on individual patient needs and preferences. Despite the positive outcomes, there were gaps in the research, particularly the need for more long-term studies and randomized controlled trials to establish a more comprehensive understanding of AAT's efficacy in schizophrenia treatment. Overall, the review underscores the potential of AAT as a beneficial co-therapeutic approach in schizophrenia, offering improvements across psychological, social, emotional, and physical health dimensions [30-36]. However, it also highlights the necessity for further research to integrate AAT effectively into psychiatric care for schizophrenia.

In conclusion, this scoping review underscores the potential of AAT as a beneficial intervention for patients with schizophrenia. While the current evidence is promising, further research is required to solidify these findings and guide clinical implementation. The integration of AAT into schizophrenia treatment regimens could enhance patient outcomes and offer a holistic approach to mental health care.

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Original Article in Health Policy

Sociodemographic and contextual variables as predictors of men's health insurance enrolment in Ghana: Evidence from a micro indicator cluster survey

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Abstract

Introduction: This study explores the ability of sociodemographic and contextual variables, including ethnicity, rural/urban residence, and region, to predict health insurance enrollment among men in Ghana.

Methods: This study employs primary data from the Ghana Micro Indicator Cluster Survey (MICS) 2017/2018. The compositional and contextual variables were tested as the main predictors of health insurance coverage in two multivariable ordinal logistic models using odd ratios and p-values after Spearman's rho correlation analysis was conducted.

Results: Spearman's rho correlation analysis revealed a positive relationship between age and health insurance coverage and a similar relationship between rural/urban residence and health insurance coverage. Educational level and wealth index quintile were the most significant predictors of health insurance coverage among men in Model 1. Including ethnicity, rural/urban area of residence, and regional location as contextual factors in Model 2 revealed an improved effect of the existing sociodemographic variables except for functional difficulty, which was not statistically significant.

Discussion: Low health insurance coverage among men can increase vulnerabilities and gendered tendencies associated with enrolment in health insurance services. The sociodemographic and geo-related context-specific variations depict the differential effects in the predictors of men's health insurance coverage.

Take-home message: Low-income countries must consider the segmentation and targeting of diverse population groups at the micro level and critically examine the sociodemographic and locational dynamics that can influence their acceptance and subscription to ex-ante coping mechanisms that can mitigate the financial burden related to healthcare costs and at the same time enhance strategies put forward to promote universal healthcare coverage.

Keywords: health insurance; men's health; health disparities; Ghana.

INTRODUCTION

Health insurance enrolment is a major platform for accessing and utilizing healthcare services in developing countries as they strive towards universal health coverage [1]. However, there are disparities in the enrolment rate due to compositional and contextual factors [2]. Gendered patterns of healthcare services utilization within urban and rural contexts, income and wealth quintiles, and effects emanating from educational levels and cognitive factors tend to influence enrolment at the individual level; health insurance enrolment among men in Ghana remains relatively low. The seemingly patriarchy tendencies in most developing countries and power dynamics among men usually facilitate the neglect of critical academic inquiry into ex-ante coping strategies employed to address their healthcare needs. In the case of Ghana, the existence of a voluntary national health insurance scheme and the volition to freely enroll in any privately regulated health insurance scheme leave the choice of enrolment in the will of individuals and adult household members, where men tend to be the major decision-makers [3]. Enshrined in the national health insurance scheme based on the National Health Insurance (NHIS) Act 2012 (Act 852) is an insurance premium component that denies the automatic enrolment of all people resident in Ghana regardless of the pluralistic fund mobilization strategies in the scheme [4-6]. Hence, individuals are likely influenced by sociodemographic and locational factors [7,8]. It has been argued that to achieve equity and the pro-poor objectives in the Ghana health insurance system, it is necessary to understand the issues design and implement such interventions appropriately [9].

Further, it has been expressed that the absence of compulsory insurance enrolment, annual enrolment and renewal arrangements, and the discretionary determination of exempted groups apart from Livelihood Empowerment Against Poverty (LEAP) beneficiaries tend to serve as barriers to enrolment [9,18,19]. Central in the literature on health insurance enrolment has been the arguments on quality of care, facility, adequacy of benefit packages, price, and convenience [1]. However, delving deeper is the potential of selected geo-demographic elements that directly and indirectly influence the perception factors. This study explores the predictive ability of sociodemographic elements such as age, education level, income level, and geo-referenced variables such as ethnicity, rural/urban residence, and region as predictors of NHIS enrolment. Thus, this study explores the predictive effects of selected categorical variables in two ordinal logistic models using data from a micro-indicator cluster study in Ghana.

METHODS

This study uses primary data from the Ghana Micro Indicator Cluster Survey (MICS) 2017/2018 to analyze the relationship between selected sociodemographic and locational variables and health insurance enrolment among men aged 15-49 years in Ghana. The data sources, variables measured, and analyses have been presented.

To provide estimates for many indicators on the situation of diverse demographic groups at the national level, rural and urban areas, and existing administrative regions, the Ghana Statistical Service undertook a micro indicator cluster survey (MICS) in 2017/2018. A multi-stage sampling frame was used to classify urban and rural areas in each region as the significant sampling strata. Subsequently, it employed a two-stage approach in selecting households established in basic enumeration units by the 2010 population and housing census. A systematic sampling approach determined 20 households in each enumeration unit where survey questionnaires were administered. Specifically, this study employed the questionnaire for individual men in every second household to all men aged 15-49 years. In all, 5,476 were eligible for the survey. However, 5,323, representing 97.2%, took part in the survey. Further, establishing ordinal logistics resulted in using responses from 4,309 respondents after excluding missing responses.

Measured items and analysis

This study used items on the men's background, marriage/union, and adult functioning. The dependent variable, health insurance enrolment, was denoted by health insurance coverage. The independent variables were age group, men's educational level, marital status, wealth index quintile, and functional difficulty, which served as compositional attributes tested in Model 1. The constructs on ethnicity, urban and rural residence, and geographic region were added as the contextual factors in Model 2.

The enumerated compositional and contextual variables were tested as the main predictive factors of health insurance coverage in two multivariable ordinal logistic models based on existing and established statistical benchmarks. The models employed the use of odd ratio (OR) and p-values to interpret the relationship in the categories of the measured items, which were not held to be redundant in the model. The models were established after an item correlation analysis using Spearman's rho correlation since the measured items were binary and categorical. The acquisition of significant correlation values was based on Spearman's rho correlation values and statistically significant values of either $p<0.001$ or <0.005. In establishing model goodness of fit, the deviance/df of 1.255 and chi-square/df of 1.050 were analyzed with the omnibus test results of $p<0.001$. The results section presents the descriptive outcome and the co-efficient in regression analysis.

Ethical aspects

UNICEF and the Ghana Statistical Service obtained verbal consent from each respondent participating. The right to use the data was granted to the Author by the Ghana Statistical Service after approval of the data request protocols. The standard guidelines can be found at http://mics.unicef.org/tools#data-processing.

RESULTS

The findings from the study are subsequently discussed. The descriptive dimension involves an analysis of the frequency and percentage variables used for the research. In all, a total of 4,309 respondent men between the ages of 15 to 49 years who participated in the study were used in the analysis.

The frequency from the dependent variable, which is health insurance coverage, showed that 1,764 (40.9%) respondents had valid health insurance (HI) coverage, whereas 2,545 (59.1%) did not have health insurance coverage. Regarding age categorization, the ages between 15 and 24 constituted 1,410 (32.7%), whereas the oldest age category of 44 to 49 years constituted 534 (12.4%). Further, the age data showed a gradual decline in respondents based on age progression, which is coterminous with the national population pyramid. The categorical variable on men's education level showed that 659 (15.3%) had pre-primary or no formal education, whereas primary and junior secondary/middle school constituted 538 (12.4%) and 1,414 (32.8%), respectively. Further, senior secondary and tertiary or higher education included 1,181 (27.4%) and 517 (12%), respectively. The identification of men in marital unions showed that 2,415 (56%) were in marital unions at the time of the survey, whereas 161 (3.7%) of the respondents had formerly been married. Moreover, 1,733 (40.2%) of the men had never married or been in union.

Table 1. Frequency distribution of sociodemographic variables.

Variable	Measured Item	N	Percent (%)
Covered by health insurance	Yes	1764	40.9%
	No	2545	59.1%
	Total	**4309**	**100.0%**
Age Group	15 to 24 years	1410	32.7%

	25 to 34 years	1285	29.8%
	35 to 44 years	1080	25.1%
	44 to 49 years	534	12.4%
	Total	**4309**	**100.0%**
Man's Education	Pre-primary or none	659	15.3%
	Primary	538	12.5%
	JSS/JHS/Middle	1414	32.8%
	SSS/SHS/ Secondary	1181	27.4%
	Higher	517	12.0%
	Total	**4309**	**100.0%**
Marital/Union status of man	Currently married/in union	2415	56.0%
	Formerly married/in union	161	3.7%
	Never married/in a union	1733	40.2%
	Total	**4309**	**100.0%**
Wealth index quintile	Poorest	1090	25.3%
	Second	677	15.7%
	Middle	732	17.0%
	Fourth	811	18.8%
	Richest	999	23.2%
	Total	**4309**	**100.0%**
Functional difficulties (age 18-49 years)	Has functional difficulty	231	5.4%
	Has no functional difficulty	4078	94.6%
	Total	**4309**	**100.0%**
Ethnicity of household head	Akan	1578	36.6%
	GA/Damgme	307	7.1%
	Ewe	538	12.5%
	Guan	148	3.4%

	Gruma	174	4.0%
	Mole Dagbani	1022	23.7%
	Grusi	190	4.4%
	Mande	15	0.3%
	Other	335	7.8%
	Missing	2	0.0%
	Total	**4309**	**100.0%**
Area	Urban	1950	45.3%
	Rural	2359	54.7%
	Total	4309	100.0%
Region	Western	433	10.0%
	Central	338	7.8%
	Greater Accra	537	12.5%
	Volta	372	8.6%
	Eastern	405	9.4%
	Ashanti	560	13.0%
	Brong Ahafo	379	8.8%
	Northern	467	10.8%
	Upper East	378	8.8%
	Upper West	440	10.2%
	Total	**4309**	**100.0%**

Note: Pre-primary or none: Pre-primary school or none; Primary: Primary School; JSS/JHS/Middle: Junior Secondary School; SSS/SHS/ Secondary Higher: Senior Secondary School Higher: Tertiary Education.

The parameter on wealth quintile, ascribed in literature as influencing the ability to pay for health insurance coverage, depicted that 1,090 (25.8%) of the respondents were in the poorest wealth quintile. The second and middle wealth index quintile constitute 677 (15.7%) and 732 (17%). 811 (18.8%) and 999 (23.2%) respondents were in the fourth and richest wealth index quintiles. The inclusive objectives of health insurance programs necessitated the examination of functional difficulty as part of the independent variables. It was observed that 231 (5.4%) of the respondents had functional problems. The descriptive statistics on the ethnicity of male household heads in the study were also obtained. Further, the area was represented by 1,950 (45.3%) and 2,359 (59.7%) of respondents living in rural and urban areas respectively. The regional data revealed that Greater Accra and Ashanti had relatively higher respondent numbers of 537 (12.5%) and 560 (13%).

Further, descriptive analysis was conducted among all the 5,476 respondents surveyed on the type of health insurance coverage before proceeding with inferential statistics on 4,309 respondents generated after the excluded cases. National health insurance coverage constituted 2,266 (41.4%), whereas health insurance through an employer constituted 20 (0.4%). Other privately purchased commercial health insurance were 14 (0.3%).

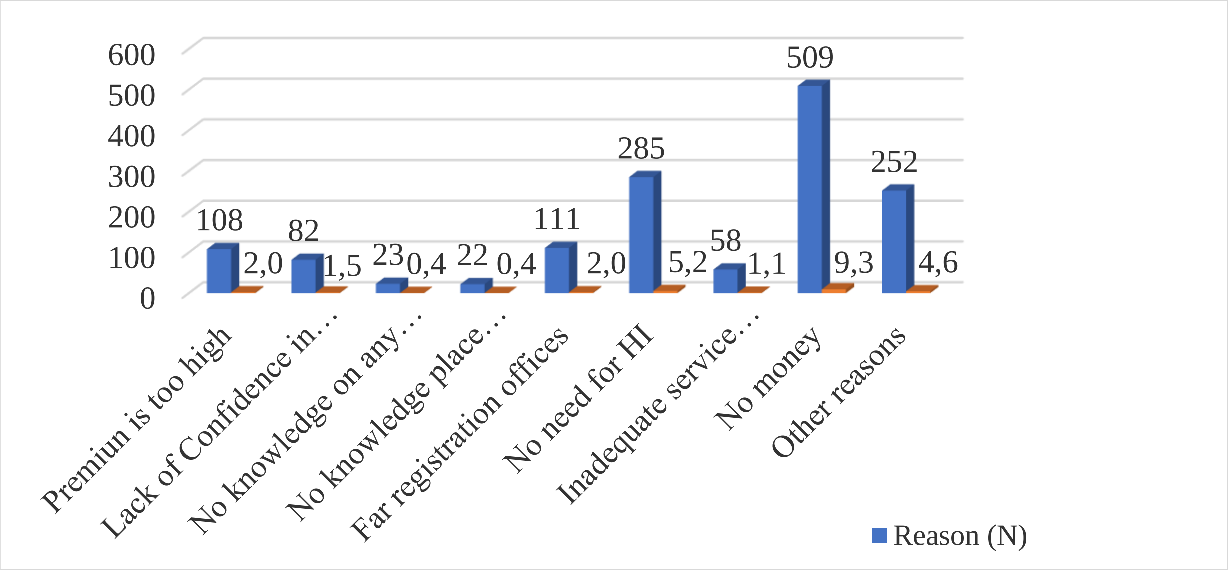

Figure 1. Reasons for non-enrolment of health insurance among men.

More importantly, the individual reasons why some respondents never registered with private insurance or NHIS were analyzed. From the survey, respondents who felt premiums were too high were 108 (2%), whereas lack of confidence in health insurance scheme operation was 82 (1.5%). The absence of knowledge of any health insurance scheme constituted 23 (0.4%), while the lack of understanding of where to register was 22 (0.4%). Other views on long distances of registration were 111 (2.1%), whereas 285 (5.2%) of the respondents did not find a need for health insurance. Further reasons include limited service or facility coverage, which constituted 58 (1.1%), and no money for enrollment, indicated by 509 (9.3%) of the respondents.

The findings from the demographic variables and subsequent observations made from the reasons assigned by respondents necessitate an examination of the effect of the antecedent compositional and contextual variables on the dependent variable of health insurance cover by first establishing a Spearman rho correlation due to the presence of binary and categorical data type and secondly ascertain the levels of effect through two multivariable ordinal logistic regression models after the goodness of fit indices have been demonstrated. The correlation results showed that age group and rural/urban residence, herein referred to as area, positively correlated with health insurance coverage, as shown by correlation values of 0.044 and 0.110 at p<0.001, respectively.

Table 2. Spearman's rho correlation analysis.

	Covered by HI	**Age group**	**Man's Education**	**Marital status**	**WIQ Functional Status (18-49 years)**	**Ethnicity Household head**	**Area**	**Region**
Covered by HI	1.000							
Age group	.044**	1.000						

Men's Education	-.168**	-.120**	1.000						
Marital status	-.066**	-.767**	.187**	1.000					
WIQ	-.127**	.075**	.543**	.014	1.000				
Functional Status (18-49 years)	-.035*	-.053**	.085**	.036*	.085**	1.000			
Ethnicity of Household head	-.054**	-.004	-.280**	-.027	-.383* *	-.002	1.000		
Area	.110**	-.023	-.373**	* -.060*	-.583* *	-.063**	.200**	1.0 00	
Region	-.151**	-.034*	-.258**	.007	-.422* *	-.021	.582**	.25 7**	1.000

Note: HI: Health Insurance * Correlation is significant at the 0.05 level (2-tailed) ** Correlation is significant at the 0.01 level (2-tailed).

Though most of the independent variables negatively correlated with health insurance coverage, there was a solid inter-item correlation among some of the independent variables. The primary objective of employing ordinal logistic regression models to ascertain the effects led to the setting up of two models made up of social demographic variables serving as the predictors of health insurance cover in model 1 and the subsequent establishment of an interactive model made up of both sociodemographic and contextual factors serving as predictors of health insurance cover in model 2. The goodness of fit indicators showed a deviance value/df of 1.255 and a chi-square value/df of 1.050. The omnibus test showed a significant value of $p<0.001$. In the model effect, only functional difficulty (disability) did not have a statistically significant effect, as demonstrated by $p=0.771$; the remaining independent variables had significant $p<0.001$ or $p<0.005$.

Ordinal logistic regression results

The results from Model 1, which analyzed the effects of age group, education level, marital status, wealth index quintile, and functional difficulty as the main sociodemographic factors influencing health insurance coverage, revealed the existence of relationships. Within the age parameters, while holding the oldest category of 44 to 49 years redundant, respondents aged 15 to 24 had an odd ratio of 1.127 with a lower bound Wald interval of 0.863 and upper bound of 1.473. Progressively, ages 25 to 35 saw an odd ratio of 1.437 with a p-value of 0.002. The ages between 35 and 44 years saw an odd ratio of 1.066 with a lower bound of 0.857 and an upper bound of 1.325. Men's education level showed a relatively higher effect on health insurance coverage as signified by odd ratios 2.943, 3.914, 3.201, and 2.030, all at $p<0.001$ for Pre-Primary, Primary, JHS, and SHS levels, respectively. The responses under marital status also demonstrated the existence of a positive odd ratio of 1.043 and 1.856, with the latter being those formerly married having a significant statistical value of 0.002.

Further, all elements under the wealth index quintile coincided with health insurance coverage, with only the poorest category showing a relatively lower odd ratio of 1.453 with $p<0.005$. The remaining quintiles showed a higher odd ratio and $p<0.001$. However, although the element of functional difficulty had an odd ratio of 1.081, it did not have a statistically significant value. The lack of finality in the effects of the demographic variables on the dependent variable augments the inclusion of contextual variables *sin quo non*, hence the establishment of Model 2.

The findings from Model 2 reveal a slight progressive effect of the age variables. Similarly, men's education level continues to be a key determinant of health insurance coverage with an improved add ratio, with the highest having a 3.932 odd ratio with $p<001$. Marital status had a relatively lower odd ratio in Model 2 than in Model 1. However, there was a significant improvement in the effects of the parameters under the wealth index, as shown by the observance of higher odd ratios ranging from 2.659 to 1.684, all at $p<0.001$. In Model 2, it was still observed that though functional difficulty had an odd ratio of 0.956, it did not have a statistically significant value.

Table 3. Ordinal logistic regression model.

Parameter Estimates	**Model 1**				**Model 2**			
Parameter	Exp(B)	95% Wald Confidence Interval for Exp(B)		p-value	Exp(B)	95% Wald Confidence Interval for Exp(B)		p-value
		Lower	Upper			Lower	Upper	
Age Group								
15 To 24 Years	1.127	.863	1.473	.380	1.112	.841	1.470	.456
25 To 34 Years	1.437	1.148	1.799	.002	1.463	1.158	1.848	.001
35 To 44 Years	1.066	.857	1.325	.565	1.090	.870	1.367	.454
44 To 49 Years	1	.	.	.	1	.	.	.
Education Level								
Pre-Primary Or None	2.943	2.208	3.921	.000	3.458	2.551	4.687	.000
Primary	3.914	2.931	5.227	.000	3.932	2.905	5.321	.000
JSS/JHS/Middle	3.201	2.541	4.033	.000	2.647	2.079	3.372	.000
SSS/SHS/ Secondary	2.030	1.619	2.546	.000	1.907	1.506	2.413	.000
Higher	1	.	.	.	1	.	.	.
Marital Status								
Currently Married/In Union	1.043	.862	1.263	.664	.965	.790	1.179	.729
Formerly Married/In Union	1.856	1.253	2.750	.002	1.557	1.033	2.348	.035
Never Married/In Union	1	.	.	.	1	.	.	.
Wealth Index								
Poorest	1.453	1.173	1.800	.001	2.659	1.996	3.542	.000
Second	1.879	1.502	2.350	.000	2.534	1.926	3.334	.000
Middle	1.738	1.406	2.148	.000	2.007	1.583	2.545	.000
Fourth	1.523	1.251	1.855	.000	1.684	1.367	2.074	.000
Richest	1	.	.	.	1	.	.	.
Functional Difficulty								
Has Functional Difficulty	1.081	.810	1.443	.597	.956	.705	1.296	.771
Has No Functional Difficulty	1	.	.	.	1	.	.	.
Ethnicity								
Akan					1.602	.098	26.193	.741
Ga/Damgme					2.029	.123	33.435	.621

Ewe	1.872	.114	30.804	.661
Guan	1.818	.108	30.462	.678
Gruma	.833	.050	13.859	.899
Mole Dagbani	1.988	.122	32.494	.630
Grusi	1.427	.086	23.581	.804
Mande	.772	.039	15.350	.865
Other	1.387	.084	22.780	.819
No Response	1	.	.	.
Urban/Rural Residence				
Urban	.828	.695	.987	.036
Rural	1	.	.	.
Region				
Western	3.416	2.379	4.905	.000
Central	7.456	4.938	11.258	.000
Greater Accra	3.492	2.430	5.018	.000
Volta	4.178	2.742	6.366	.000
Eastern	2.845	1.977	4.094	.000
Ashanti	2.408	1.728	3.357	.000
Brong Ahafo	1.183	.846	1.655	.326
Northern	1.350	1.010	1.805	.043
Upper East	.748	.558	1.001	.051
Upper West	1	.	.	.

Note: OR= Odd Ratio, CI=95% Wald Confidence Interval for Exp (B), 1= Set to zero because this parameter is redundant.

Introducing the contextual or geo-related variables of ethnicity, area (rural/urban), and regional location generally improved the predictive abilities of the previous sociodemographic factors. Preceding that improvement, the parameters under ethnicity had higher odd ratios; however, none of the parameters under this construct had a significant p-value. Departing from ethnicity, rural/urban residence showed an odd ratio of 0.828 with a lower Wald interval of 0.695 and an upper Wald interval of 0.987 at a p-value of 0.036. Subsequently, most of the parameters under regional location had the highest odd ratio, with a region exhibiting an odd ratio of 7.456 with a lower bound of 4.938 and an upper bound of 11.258 at p<0.001. Thus, the interplay of sociodemographic and geo-related factors accentuates the tendency of health insurance enrolment among men in this study.

DISCUSSION

The study explored the effects of selected compositional and contextual factors on men's health insurance coverage using data obtained through a nationally representative micro indicator cluster survey. The preliminary section of the results presented a descriptive analysis of the frequency and percentages of the measured items. The selection of age, education level, wealth index quintile, and marital status as key sociodemographic determinants of health insurance enrolment were supported by existing studies [1,6,8]. However, this study delves deeper into examining the influence of these variables on a mono-gender group, herein being men between the ages of 15 to 49 years.

The inclusion of functional difficulty among men as an independent variable in this study was to help ascertain the effect of the parameter as a critical instrument for achieving the inclusive and pro-poor objectives of Ghana's national health insurance scheme. Concerning the innate reasons behind the non-subscription to health insurance schemes, it was observed that high premium packages did not account for the significant reason. This can be attributed to the pluralistic sources of funding for the health insurance scheme, where the majority of the covered respondents had subscriptions, as indicated by 41.4% of the men surveyed. However, lack of money to register for insurance in private and public schemes constituted the main reason among 9.3% of the respondents, followed by the reasons for not requiring insurance. It can be deduced from the findings that the majority of the respondents knew of a health insurance scheme. However, lack of confidence in the scheme's operation, as signified by 1.5%, and the issue of far proximity to the registration office, as indicated by 2.1% of the total respondents surveyed, were cited as reasons for never registering for health insurance. By and large, the data obtained from the reasons did not account for the considerable gap between the currently enrolled respondents, who are 40.9%, and non-enrolled respondents, who are 59.1%. Hence, there is a need for an extensive examination of the sociodemographic and context-specific underpinning factors behind health insurance coverage among men.

Spearman's rho correlation analysis revealed a positive relationship between age and health insurance coverage and a similar relationship between rural/urban residence and health insurance coverage. These findings are consistent with the findings of several authors [1,10,11], who found a similar relationship between these demographic and contextual factors and health insurance enrolment within general demographics.

Subsequently, establishing two multivariable ordinal logistic regression models testing the effects of the sociodemographic variables in one dimension and proceeding to compound the sociodemographic and contextual variables in the second model led to observing significant predictive impacts of some of the constructs. At 95% confidence intervals, it was observed that educational level and wealth index quintile were the most important predictors of health insurance coverage among men in Model 1, as signified by an odd ratio of 3.914, 95% CI, 2.931 – 5.227; p = 0.000, and odd ratio of 1.879; 95% CI, 1.502 – 2.350;) p = 0.000 for education level and wealth index respectively. This implies that while other variables in the model are held constant, higher education or wealth will increase the odds of men having health insurance coverage in Ghana.

Further, the addition of ethnicity, rural/urban area of residence, and regional location as contextual factors in model 2 revealed an improved effect of the existing sociodemographic variables except for functional difficulty, which was still insignificant. The insignificance of functional difficulty may be attributed to existing national policies that target the exemption of vulnerable groups from paying for national health insurance schemes and programs such as the Livelihood Empowerment Against Poverty (LEAP) [9,12,13]. More importantly, it was ascertained that ethnicity was not a significant predictor of health insurance coverage in the study. Mainly seen as a social solidarity and a tool for national and political cohesion, the national health insurance scheme, which the respondents assert as the main health insurance subscribed in this study, does not adversely select voluntary subscribers based on ethnic affiliation and hence the observance of these results.

The findings also showed that rural-urban residence significantly predicts health insurance coverage among men in this study. Urbanization can create access to healthcare facilities while enhancing proximity and reducing travel time to obtain health insurance registration and services. Finally, most of the parameters under region demonstrate that the regional construct was a significant predictor of health insurance coverage among men. The variations in regional levels of development and disparities in healthcare resources could account for the greater odd ratios and non-statically significant values observed in a few regions.

Study limitation

The study acknowledges the significance of gender equity and social inclusion considerations in research. However, this paper predominantly focuses on the relatively low health insurance enrollment of men in Ghana and within the context of most developing countries. The reasonably significant low health insurance enrolment among men, coupled with deep-seated adverse socio-cultural norms, may have spiral effects on health outcomes among men and other demographic groups. Hence, there is a need for considerable health marketing and financing strategies in research, segmentation, and targeting efforts to advance the discourse on individual, household, and communal level health insurance policies.

CONCLUSIONS

The study explored the relationship between selected compositional and contextual attributes and health insurance enrolment among men while not overlooking the perceived reasons for never subscribing to health insurance coverage. While acknowledging the relative dominance of men in communal and household decision-making as a result of deeply entrenched patriarchy and power dynamics in the study context, patterns of low health insurance coverage among the respondents revealed levels of vulnerabilities and gendered tendencies associated with enrolment in health insurance service. Though all men were interviewed in this study, variances in sociodemographic and context-specific factors led to differential effects in men's health insurance coverage. As developing countries strive to achieve universal health coverage for the greater population, it is crucial to consider segmentation and targeting of diverse population groups at the micro level and critically examine sociodemographic and locational dynamics that can influence acceptance and subscription to ex-ante coping mechanisms that can mitigate the financial burden associated with healthcare cost and at the same time enhance strategies put forward to promote universal healthcare coverage. Thus, efforts to improve health insurance coverage among men should focus on improving opportunities for general education, wealth, and residential equality in health insurance registration and healthcare delivery services.

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Advances in Medicine, Psychology and Public Health (AMPPH)

Original Research in Orthopedy and Rehabilitation

Effects of custom mold with peripheral textured surface foot orthosis on balance and physical function in subjects with chronic ankle instability

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Abstract

Introduction: Currently, healthcare professionals recommend an initial conservative approach consisting of non-pharmacological approaches for chronic ankle instability. We developed a foot orthosis targeting both mechanical and functional instability in these patients, aiming to investigate its effects on balance and physical function.
Methods: This research is a randomized controlled trial that included 45 young individuals who are active and have chronic ankle instability. The participants were recruited from sports clubs. The participants were separated into three groups: a control group without any intervention, a group prescribed with a custom mold foot orthosis, and a group prescribed with a custom mold with peripheral textured surface foot orthosis. Balance was assessed using single-leg balance and single-leg hop tests, while physical function was evaluated using the FAAM questionnaire. Data analysis was performed using one-way analysis of covariance statistical test.
Results: Both types of foot orthoses were found to enhance balance and physical function. The foot orthosis with peripheral textured surface exhibited superior results compared to custom mold foot orthosis, as it significantly increased the score of the single leg hop test ($p=0.01$) and the FAMM-sport section ($p=0.002$).
Discussion: The foot orthosis with peripheral textured surface can potentially optimize the subtalar joint alignment and modify the sensory input generated by the activation of mechanoreceptors located in the sole region of the foot. This alteration may further enhance balance and physical function.

Take-home message: Foot orthoses, designed to change the action of the sensorimotor mechanism in the human body, have demonstrated favorable outcomes in improving balance and physical function among chronic ankle instability subjects.
Key words: balance; chronic ankle instability; insole.

INTRODUCTION

Lateral ankle sprain (LAS) is a prevalent musculoskeletal damage that impacts both athletes and individuals engaged in physical activity [1]. This injury accounts for 33-73% of ankle injuries [2]. Approximately 23,000 sprains occur daily in the United States [3,4], although the actual statistics are higher because 56.8% of people who experience sprains do not seek medical treatment [3,5]. In 55 to 72 percent of patients, despite the rehabilitation process, chronic symptoms such as giving way and repeated LAS persist in the ankle joint [6,7]. Such Repetitive injuries can cause Chronic Ankle Instability (CAI). CAI is marked by mechanical, functional, or both types of instability [8]. In cases of mechanical instability, the joint capsule and ligaments become lax as a result of acute LAS. This laxity leads to increased subtalar joint lateral misalignment and a heightened risk of re-spraining due to greater inversion torque during rapid movements. Sensory disorder of the ankle and foot complex is the main cause of functional ankle instability. The function of the sensorimotor system relies on afferent signals from joints, tendons, ligaments, capsules, and skin mechanoreceptors [8-11]. During LAS, the mechanoreceptors in the lateral skin, ligament, and ankle capsule are compromised, as they have a low capacity for withstanding tensile forces [12]. Difficulties in ankle joint physical function among individuals with CAI can stem from deficits in peroneal and tibialis anterior muscle reactions [13], local sensory perception [12], proprioception, and balance [14-17].

The most common treatment approaches derived from rehabilitation programs place significant focus on improving balance [18] and physical function [19]. Orthotic devices are frequently utilized in the rehabilitation process for these patients. Ankle and Foot Orthoses (AOs and FOs) have been proposed as potential solutions to address balance deficits in this population [18,20]. While AOs have shown efficacy in preventing LAS [21], the restriction of ankle motion caused by these orthoses may lead to adverse effects on the knee due to alterations in the closed kinematic chain of the lower limb [22].

The satisfaction rate reported by patients using FOs was 70-80% [23]. FOs show different effects according to their design and purpose. They have been employed to regulate heel-to-toe movements [24-26], diminish biomechanical stress [27], provide arch support [28], and position the subtalar joint in a neutral alignment [24,28] in repetitive LAS. In three studies, FOs were used to improve the sensory input with textured surfaces [28-30]. There is a high concentration of mechanoreceptors in the plantar region of the feet [31]. The significance of plantar foot mechanoreceptors becomes more prominent in CAI when there is a lack of valuable sensory information received from the mechanoreceptors located on the lateral structure of the ankle [32].

In research studies, custom-molded and textured FOs have received more attention [33]. Custom-molded FOs primarily aim to restore foot alignment, whereas textured FOs have been studied for their impact on sensory input [33]. It is important to note that patients with CAI may experience different instabilities [8], which may not be effectively addressed using the same type of FOs. One potential approach to enhance the therapeutic impact of orthotic treatment for CAI is to integrate a textured surface into custom-molded FO [28]. This modification can potentially augment the orthosis's positive effects, catering specifically to the mechanical and functional instabilities of CAI patients.

Maki et al. suggested a unique form of textured surface characterized by a raised ridge positioned around the perimeter instead of an array of indentations typically used to stimulate mechanoreceptors on the foot sole. The authors proposed that this design aids the central nervous system in perceiving the borders of the base of support. As the center of mass approaches the edges of the base of support, a slight concavity forms along the foot's skin, resulting in stimulation of mechanoreceptors in the sides of the foot and subsequent changes in afferent sensory input transmission [34]. Subsequent research has further investigated the implementation of prefabricated FOs equipped with a peripheral textured surface to improve balance [35-37]. In this study, we made a modification to a custom-molded FO by incorporating a peripheral raised ridge. The effects of using the custom mold with a peripheral textured surface FO (CPTFO) on balance and physical function were assessed for a duration of 4 weeks. These effects were then compared to a group using custom mold FO (CFO) and a control group without any intervention.

METHODS

Study setting

This randomized controlled trial took place between March 2022 and May 2023. The study protocol received approval from the Ethics Committee of the University of Social Welfare and Rehabilitation Sciences, with the assigned code IR.USWR.REC.1400.301. Participants were given a consent form to read and sign before participation. Data collection procedures were carried out at the Orthotics and Prosthetics Department of the University of Social Welfare and Rehabilitation Sciences. Participants in the intervention groups were instructed to use FOs for a duration of 4-8 hours daily over a period of 4 weeks. One of the researchers conducted weekly phone calls to assess and monitor the amount and manner of FO usage. Each participant underwent assessment twice, once before starting the intervention and again after 4 weeks of FO usage.

Study population

A total of 45 patients were recruited from sports clubs in Tehran province, Iran. To be eligible, patients with CAI needed to meet specific criteria outlined by the statement released by the International Ankle Consortium [38]. These factors included: (1) Patients must have a documented history of at least one significant LAS occurring 12 months or more prior to the study, resulting in inflammatory symptoms like pain and swelling that caused a disruption in desired physical activities lasting for at least one day; (2) Patients should self-report ankle joint instability and have experienced multiple recurrent ankle sprains (at least two episodes) within the six months leading up to the study.

Subjective feelings of instability were further confirmed using the Cumberland Ankle Instability Tool (CAIT), a validated questionnaire with a score below 24 indicates the presence of CAI (Persian version); (3) Participants were required to score below 90% in the daily activities section and below 80% in the sports activities section of the Persian version of the Foot and Ankle Ability Measure (FAAM) questionnaire. The study also had specific exclusion criteria, including: (1) Prior lower extremity operation bone fracture (2) Balance problems caused by underlying diseases such as diabetes and cavus deformity.

Randomization

Participants were randomly categorized into one of three groups: CPTFO, CFO, or a control group with no intervention. The randomization was performed in an equal distribution of 1:1:1 using a block randomization method with a block volume of 6.

Blinding

The study employed a concealed allocation procedure, ensuring that the examiner remained unaware of the allocation. This was accomplished by utilizing sealed opaque envelopes. Randomization responsibilities were assigned to an individual separate from the examiner and therapists involved in the study. Furthermore, statistical analyses were performed by an independent biostatistician who was not responsible for conducting the examinations, interventions, or randomization.

Interventions

To fabricate both orthoses, negative casts of the foot were constructed using plaster bandage while the patient was seated on a chair, ensuring that the subtalar joint remained in a neutral position, the midtarsal joint in maximum pronation, and the first ray in a neutral alignment [39] (p. 202). All negative casts were obtained by an orthotics and prosthetics specialist. Polypropylene sheets with a thickness of 5 mm were heated to 140 degrees and stretched onto modified positive molds. This process resulted in the creation of CFO (Figure 1A). The CFO primarily consisted of a medial longitudinal arch support and a 2 cm heel cup. The orthosis trim was expanded on both sides below the medial and lateral malleolus. The length of the orthosis was extended to reach the metatarsal heads. To produce CPTFO, a layer of soft foam (shore 30) with a thickness of 1 mm was initially affixed to the upper surface of the CFO. Subsequently, a 3 mm diameter strip of ethylene vinyl acetate foam (Shore A50) was attached along the edge of the CFO, maintaining a distance of 1 centimeter from the edges (Figure 1B).

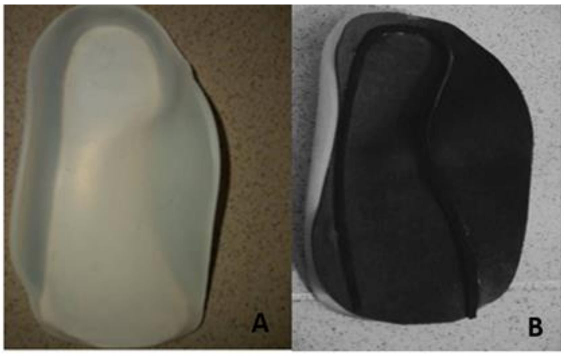

Figure 1. (A) Custom mold FO; (B) Custom mold with a peripheral textured surface FO.

Study outcomes

The study evaluated four outcomes: dynamic balance, static balance, Activity of Daily Living (ADL), and sports activity. Dynamic balance was assessed using the Single Leg Hop Test (SLHT), which required participants to jump as far as possible using their affected side while landing in a controlled and stable manner. There were no restrictions on body or arm movements during the test. The distance between the starting point and the endpoint, as indicated by the placement of the heel, is measured and recorded in centimeters.

The Single Leg Stance Test (SLST) was used to assess static balance. Participants stood on their affected leg while placing their hands on the iliac crest, with the unaffected knee flexing but not touching the weight-bearing limb. The objective was to sustain this posture for a duration of 30 seconds while keeping their eyes closed. The investigator recorded various parameters, including instances of the sound leg or weight-bearing leg touching the floor, foot displacements from the starting position, hand separations from the iliac crest, and eye openings. The number of errors was recorded for subsequent analysis.

Previous studies have confirmed the efficacy of SLHT and SLST in identifying balance impairments related to musculoskeletal injuries such as CAI [40,41]. Prior to conducting these tests, participants received instructions to ensure accurate performance. They performed the tests three times for familiarization and learning purposes, and then the average of the three main test results was used for analysis.

Physical function was evaluated using FAAM questionnaire, which assessed physical function across two levels: ADL and sports activity. The ADL section consisted of 21 questions, while the sports activity section comprised 8 questions. Scores on the questionnaire ranged from 0 to 84 for the ADL section and from 0 to 32 for the sports activity section. The reliability and validity of the Persian version of FAAM for assessing functional limitations in individuals with foot and ankle abnormalities have been documented [42].

Statistical analysis

G power software (version 3.1) was used to calculate the sample size (power: 80%, confidence level: 95%, and effect size: 0.45) [39]. The final sample size comprised 45 participants, with 15 individuals allocated to each of the 3 groups.

We used SPSS software (version 26) for statistical analysis. One-way analysis of variance was used to detect differences in demographic characteristics. Within and between group changes were analyzed with paired t-tests and analysis of covariances tests, respectively. Cohen d effect was run to show the interventions effectiveness.

RESULTS

Out of the 45 participants initially assigned to the three groups, 43 individuals successfully finished the study. The flow diagram, following the CONSORT statement guidelines, is depicted in Figure 2.

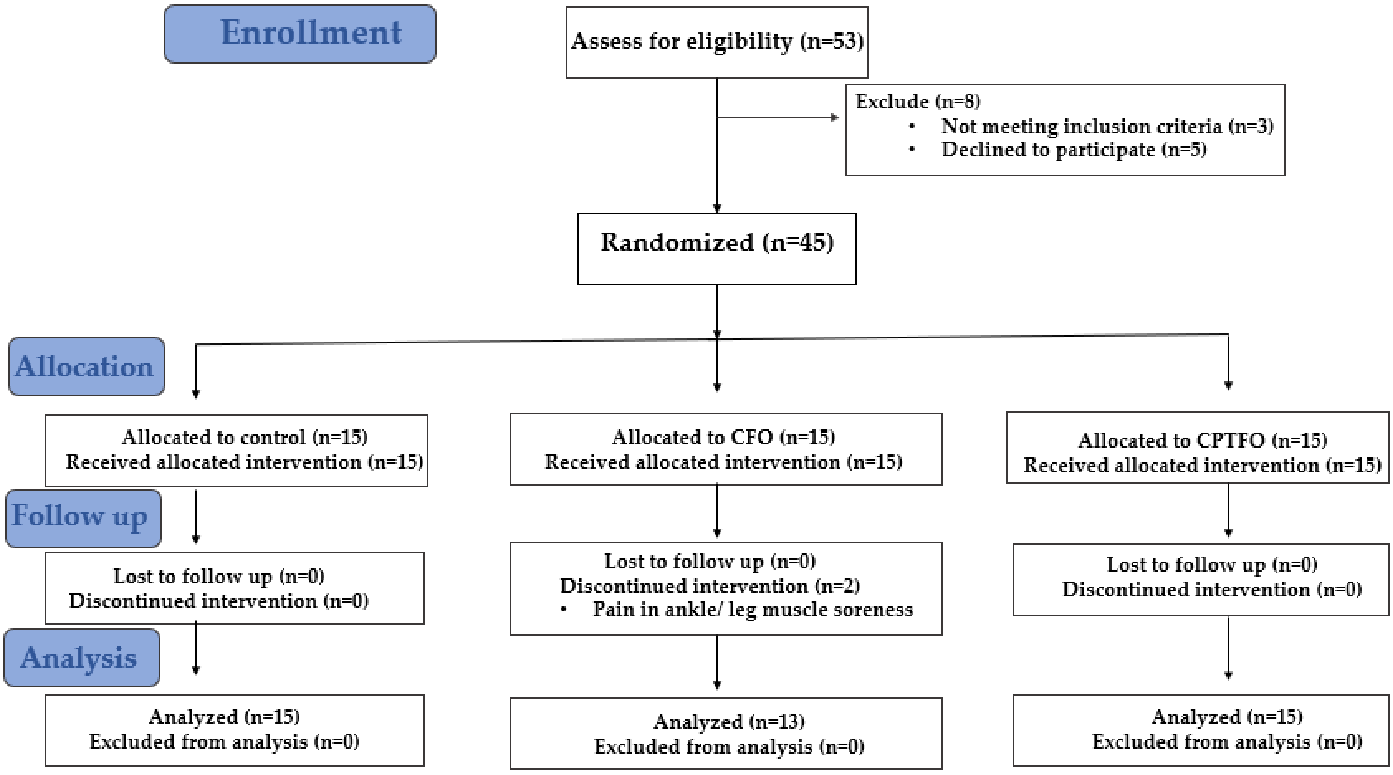
Enrollment
Assess for eligibility (n=53)
Exclude (n=8)
Not meeting inclusion criteria (n=3)
Declined to participate (n=5)
Randomized (n=45)
Allocation
Allocated to control (n=15)
Received allocated intervention (n=15)
Allocated to CFO (n=15)
Received allocated intervention (n=15)
Allocated to CPTFO (n=15)
Received allocated intervention (n=15)
Follow up
Lost to follow up (n=0)
Discontinued intervention (n=0)
Lost to follow up (n=0)
Discontinued intervention (n=2)
Pain in ankle/ leg muscle soreness
Lost to follow up (n=0)
Discontinued intervention (n=0)
Analysis
Analyzed (n=15)
Excluded from analysis (n=0)
Analyzed (n=13)
Excluded from analysis (n=0)
Analyzed (n=15)
Excluded from analysis (n=0)

Figure 2. Consort Statement follow diagram.

Table 1 presents a summary of the demographic data for the participants. At the study's beginning, significant weight and age disparities were observed among the three participant groups. Recognizing these variables as potential confounding factors, adjustments were made during the ANCOVA analysis to minimize their influence on the results.

Table 1. Mean ± SD values of demographic variables and the result of one-way analysis of variance for these variables.

	Control	**CFO**	**CPTFO**	**P value**
Age	25.73±3.9	26.40±7	23.91±4.9	**0.01**
Weight	65.8±11.3	63.8±11.6	67.1±8.9	**0.04**
Height	161.8±4.7	163.07±7.5	164.1±8.3	0.32
CAIT score	14.8±3.1	15.2±1.4	15.8±3.2	0.16
FAAM- sport (%)	67.5±9.99	65.5±10.4	76.11±14	0.98
FAAM-ADL (%)	79.5±7.8	80.3± 5.9	67.8±13.9	0.05
Time since last LAS	20.8±5.14	21.9±4.47	24.3±4.2	0.17

Note: CAIT, Cumberland Ankle Instability Tool; FAAM, Foot and Ankle ability measure; ADL, activity of daily living;

Within-group comparisons demonstrated significant improvements FAAM-ADL, FAAM-sport, SLST, and SLHT for two intervention groups, while no significant results were observed for the control group (Table 2).

Table 2. Paired t-test and effect size for outcomes.

	Group 1: control	**P value**	**Cohen d**	**Group 2: CFO**	**P value**	**Cohen d**	**Group 3: CPTFO**	**P value**	**Cohen d**
FAAM ADL (%)									
pre	79.5±7.8	0.9	0.08	80.3± 5.9	**0.02**	**0.45**	67.8±13.9	**0.01**	**0.33**
post	80.1±6.8			84±5.6			71.6±11.3		
FAAM sport (%)									
pre	67.5±9.99	0.6	0.13	65.5±10.4	**0.01**	**0.84**	76.11±14	**0.001**	**0.9**
post	68.8±8.7			70.68±9.9			86.5±5.53		
SLST									
pre	7.21±4.75	0.65	0.07	8.54±5.9	**0.001**	**1.89**	8.42±5.4	**0.001**	**2.18**
post	7.29±4.5			3.13±4.1			2.96±2.1		
SLHT									
pre	104.2±31.8	0.76	0.05	68.7±20.3	**0.009**	**0.89**	88.9±20.1	**0.001**	**1.95**
post	104.36±31.7			84.9±24.5			110.8±18.2		

Note: SLST, single leg stance test; SLHT, single leg hop test

Effect levels of 0.2, 0.5, and 0.8 are widely acknowledged as small, moderate, and large, respectively. This study's findings revealed moderate to large effect sizes (d = 0.33-2.18), indicating support for the clinical effectiveness of both interventions.

Table 3. Mean values ±SD of differences of outcomes and the analysis of covariance results.

	Group 1: control	Group 2: CFO	Group 3: CPTFO	Results of co-variate analysis	Significant results in Bonferroni comparison
FAAM ADL (%)	0.6±2.6	3.7±1.4	3.8±3.2	0.01	**1<2, 1 <3**
FAAM sport (%)	1.3±2.3	5.18±2.5	10.39±2.6	0.003	**1 <2, 1<3, 2 <3**

SLST	0.08±1.2	-5.41±1.3	-5.46±1.05	0.01	**2<1, 3<1**
SLHT	0.16±8.1	16.2±5.8	21.9±4.9	0.001	**1 <2, 1<3, 2 <3**

The analysis of covariance results revealed significant differences between the groups for all four outcome measures, as shown in Table 3. Post hoc analysis revealed that both the CFO (p=0.001) and CPTFO (p=0.001) groups exhibited significantly higher scores in FAMM ADL compared to the control group. However, the CPTFO group exhibited higher FAAM sports scores compared to the CFO group (p=0.002) and the control group (p=0.001).

Regarding the number of errors in SLST, the control group had a significantly higher count compared to both the CFO group (p=0.001) and the CPTFO group (p=0.001). Additionally, the SLHT distance in centimeters was higher in the CPTFO group relative to both the CFO group (p=0.01) and the control group (p=0.001).

DISCUSSION

The findings of this study suggest that both types of FOs significantly impact static and dynamic balance, as measured by SLBT and SLHT, respectively. Moreover, the results indicate that CPTFO has a greater effect on the FAAM sport section and SLHT.

The primary outcome of this study revealed an improvement in balance and physical function through the use of CFO and CPTFO. These results are consistent with prior studies emphasizing the efficacy of FOs in improving balance in individuals with CAI [18]. It is proposed that FOs elicit both mechanical and functional impacts on the foot and ankle motions in CAI [28,29].

Two studies have reported that CFOs incorporating a heel cup and medial longitudinal arch support have the ability to significantly enhance the reaching distance in the SEBT [28,43]. The SEBT is considered a reliable assessment tool for detecting balance impairments in individuals with CAI [44]. LAS can result in excessive motion of the subtalar joint and lead to tilting of the talus while standing in the talocrural joint [8]. CFOs have been found to influence balance maintenance through several mechanisms, including reducing the subtalar joint range of motion [28,45], promoting proper alignment of the foot [46], and alleviating stress on the foot and ankle complex muscles [25].

The second outcome of this study demonstrated that CPTFO expressed superior improvements in SLHT performance and the score of the FAAM sport section for patients with CAI, when compared to both the CFO and control groups.

Previous studies have demonstrated the beneficial impact of textured FOs on balance improvement [28,29]. The improvement of FAAM sports scores can be seen as the reason that dynamic balance is the basis of physical function [47]. The primary reason for the effect of textured FOs is the alteration in the quantity and spatiotemporal patterns of sensory feedback from the foot sole [48].

The third finding of this study indicated that CPTFO did not have a significantly higher impact on SLST and FAAM-ADL compared to CFO. It has been suggested that static tests may not provide sufficient challenge to effectively assess the sensorimotor system [40]. The enhanced stability provided by CPTFO is particularly noticeable during activities that involve a greater challenge to balance, such as sports activities [49]. The primary motions of the ankle joint, namely plantarflexion, and dorsiflexion, occur within the sagittal plane. The range of motion within this plane typically spans from 65 to 75 degrees, incorporating 10 to 20 degrees of dorsiflexion and 40 to 55 degrees of plantar flexion [50]. In ADLs like gait, around 10 to 20 degrees of dorsiflexion are necessary, while sports activities like running require up to 30 degrees, and squats require approximately 40 degrees [51]. In sports activities, various body parts deviate further from their anatomical position, necessitating greater coordination to maintain balance. This observation emphasizes the role of the peripheral raised ridge in improving afferent information from mechanoreceptors.

It is crucial to acknowledge that this study also encountered certain limitations. It is essential to note that this study was conducted exclusively on a sample of active young individuals with CAI. Therefore, caution should be taken to not generalize the results to the broader population or patients who frequently experience sprains due to underlying conditions such as Cavus deformity. Furthermore, this study focused on examining the short-term effect of using insoles over a one-month period. To explore the long-term impact, further studies should be designed and conducted. Finally, the strength of the peroneal muscles, which play a crucial role as the primary lateral stabilizers of the ankle, was not measured. This decision was based on the assumption that individuals involved in sports activities typically exhibit a muscle grade ranging from 4 to 5. For future study designs, it is recommended to address the aforementioned limitations. Additionally, it is suggested that the designed FOs be compared with other types of FOs specifically intended to impact the sensorimotor system of the human body, as well as commonly used orthoses for the target population.

CONCLUSIONS

Both the CFO and the CPTFO have demonstrated the ability to enhance static and dynamic performance in patients with CAI. However, it is worth noting that the CPTFO appears to be the preferred choice among these two FOs for prescribing to these patients. This particular FO exhibits a greater impact on improving SLHT performance and the FAMM sports section.

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Original Article in Clinical Psychology

Zipf's law: Divergence from general content in online communities of peers affected by attention-deficit/hyperactivity disorder (ADHD) and anorexia nervosa

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Abstract

Introduction: Psycholinguistics studies the relationship between linguistic behavior and psychological factors. For what concerns ADHD (Attention-Deficit/Hyperactivity Disorder) and anorexia nervosa, psycholinguistics can offer insights into the language-related aspects of these conditions. The current study aimed to describe the relationship between rank frequency and frequency of use in written corpora retrieved from internet content.

Methods: Linguistic content was retrieved from online communities (Reddit). A total of 2,500 unique contributions were collected for each community (ADHD, anorexia nervosa, general content), composed of an initial script and each subsequent elicited comment. Zipf's law was adopted to estimate the constant and exponential terms describing the relationship between word frequency rank and total usage.

Results: A total of 17,853 and 10,049 written prompts were retrieved for ADHD and anorexia nervosa, respectively. This content was compared to 13,386 comments from a general community. The ADHD community exhibited a higher number of average comments per submission, while both ADHD and anorexia nervosa showed higher words per post than the general community. Zipf's law exponential and constant terms were also higher between ADHD and anorexia nervosa compared to general content, suggesting a higher frequency of rare terms in these communities. Notably, while general content emphasized etiquette and community moderation, ADHD and anorexia nervosa discussions predominantly revolved around psychopathological terms.

Discussion: This study underscores the unique linguistic characteristics within these communities, shedding light on the interplay between linguistic behavior and psychological factors in the context of ADHD and anorexia nervosa. Psycholinguistic tools could aid in the development of a better understanding of the lived experience of individuals suffering from a psychiatric disorder.

Take-home message: This study shows unique linguistic patterns in ADHD and anorexia nervosa online discussions, emphasizing psycholinguistics in understanding language use in online media.

Keywords: communication; neurodivergence; internet use; quantitative linguistics; psycholinguistics; social media.

INTRODUCTION

In language, as in other realms of life, emergent properties can originate from the need to allocate scarce resources [1], [2]. For instance, in communication, in light of cognitive constraints, a balance must be reached between effectiveness, speed, specificity, and parsimony [3]. Empirical laws attempt to describe these emergent properties in language. Among them, Zipf's law formulates that the frequency of a word (in a written corpus of natural languages) is inversely proportional to its occurrence rank [4]. In other words, the most common word occurs twice as often as the second most common word, three times as often as the third, and so on. Early evidence showed that Zipf's law may not be maintained in speech or written forms of language in neurodevelopmental disorders, such as Autism Spectrum Disorder [5,6]. As another example of neurodevelopmental disorders, ADHD shows a similar onset and overlapping characteristics with Autism Spectrum Disorder [7,8], but no previous work has explored Zipf's law in this clinical population. However, several empirical accounts described a high rate of language deficits in children with ADHD [7,9], warranting a higher focus on this topic.

By contrast, Anorexia Nervosa (AN) has not been described as being associated with language deficits and does not show evidence in support of neurodevelopmental divergences [7]. Nonetheless, overlapping symptomatic characteristics have been observed between AN and Autism Spectrum Disorder [10]. Moreover, chronic calorie restriction is known to reduce cognitive functioning, but a complex mechanism might underlie differential longitudinal trajectories based on sex and onset of restriction [11]. In fact, animal studies offered evidence that late-onset restriction may worsen cognitive performances, while conversely, exposure to calorie restriction during development might be protective and beneficial [11]. However, the effect of calorie restriction seems selective for specific functions [12] and may not encompass all cognitive domains [13].

General and specific psychopathology might interfere in the before-mentioned allocation of scarce resources for what concerns language. Depression and social anxiety influence verbal expression by emotional status, interpersonal stances, and cognitive processes [14-16]. In ADHD, specific psychopathology might interfere with the law describing the relationship between rank and frequency of use for words in neurotypical linguistic corpora. Core symptoms such as inattention and hyperactivity might tax-writing or reading skills [17,18]. Additionally, complex phenomena such as hyperfocus or proficiency in uncommon interests might stress vocabulary divergence [19-21]. To the authors' knowledge, no study has observed language deficits in clinical samples of patients affected by Anorexia Nervosa. Yet, the scientific literature has focused on the social aspect of eating disorders [22], and a specific lexicon, morally driven and morally informed, might stress vocabulary divergence and use in patients or the general public interacting with them [23].

Aims and hypothesis

For these reasons, a necessary discrimination between the contribution of general and specific psychopathology is needed before natural language processing might inform clinical practice. The current study aimed to describe the relationship between rank frequency and frequency of use in written corpora retrieved from internet content. Written corpora of online communities of peers affected by ADHD and Anorexia Nervosa were compared with general contents, unspecific of psychopathology.

The working hypothesis was that online communities devoted to specific psychopathologies would see an overinflation of most frequent words (those associated with conditions, needs, and symptoms) and less frequent use of singular vocabulary.

To control for these factors, the most distinct words for each community were computed and described.

METHODS

Sample description and pre-processing

The community of r/ADHD is an inclusive, disability-oriented support group of peers affected by ADHD. The community welcomes sharing stories, difficulties, and non-pharmaceutical strategies to cope with symptoms. The community has almost 1,5 million subscribers, with the highest growth between 2018 and 2021. The subreddit r/Anorexia Nervosa describes itself as a safe place for those affected by the disorder or in recovery. It counts approximately 36,720 subscribers and had the highest growth between 2019 and 2021. By contrast, the board of r/ShowerThoughts is devoted to sharing general wisdom gained during ordinary events. It mainly grew between 2014 and 2019 and counts over 25,126,800 to the present day.

These three reddit communities were searched, and a random sample of 2,500 posts was selected for each subreddit. All comments posted for each 2,500 submissions were retrieved, and a final written corpus of all posts and comments was defined for each community. The sample size and procedure reflect previous work on analyzing mental health correlates on social media platforms like Reddit [24]. To avoid over-sampling lexicon associated with COVID-19, pandemics, infectious diseases, contagions, or symptoms [25], only submissions and comments posted between 1 January 2019 and 31 December 2019 were included. All analyses were conducted in Python 3.8.13, with the support of the following libraries: "pandas" [26]; "numpy" [27]; "scipy" [28]; "matplotlib" [29]; "clean-text" [30]; "seaborn" [31]; "ntlk" [32]; "genism" [33]; "sklearn" [34].

Each community's written corpus was pre-processed to remove the upper case, punctuation, control characters, URLs, line breaks, e-mails, phone numbers, numbers, digits, and currency symbols [30]. The overall written corpus was divided into words, and each word stemmed to retrieve its lexical meaning [32]. Stop words (e.g., "the", "not", "and" etc.) were removed [32,33]. Both stemming and word stops were performed according to standard practices in natural language processing [32].

Empirical distribution of frequency and rank

Zipf's law is defined by the following:

$$f(N) = \frac{1}{C * N^{Z}}$$

That is, the frequency of the Nth word is given by the power law with exponent Z. The standard Zipf's law describes Z = 1, while C is a constant that allows the distribution to be unitary. In order to fit Zipf's distribution to each corpus, the Maximum Likelihood Estimation (MLE) of Z was derived according to procedures defined by Moreno-Sánchez and colleagues [35]. The goodness of fit was evaluated by computing each curve's Mean Absolute Error (MAE; [36]) and Mean Squared Log Error (MSLE; [34]). The MAE of a model is given by the sum of differences between observed and predicted values divided by the sample size [36]. As exponential distributions, standard measurements such as Mean Squared Error (MSE) might be biased in the logarithmic scale. For these reasons, a variation of MSE, namely MSLE, which computes the relative difference between observed and predicted values and the percentual difference between them, was preferred [34].

Most distinctively frequent words

In order to characterize the most distinctively frequent words, the Text Frequency – Inverse Document Frequency (TF-IDF) was adopted [32]. TF-IDF counts the number of times a term occurs in a document and divides it by the total number of documents where the same term appears. This procedure aims to reduce the weight of very frequent but not distinct terms in a document. A selection of the top 10 words by TF-IDF score was chosen to represent the most distinct words for each community.

RESULTS

Sample descriptives

A total of 2,500 submissions were retrieved, as planned, for each of the three online communities described. Comments posted for each submission were associated with the original body of text, and 41,288 comments were analyzed. In particular, the community of peers affected by ADHD had 17,853 comments and an average of 7.141 comments per submission. The community of peers affected by Anorexia Nervosa had a total of 10,049 comments and an average of 4.020 comments per submission. Finally, the general community, unspecific of psychopathology, had a total of 13,386 comments and an average of 5.354 comments per submission. Please see Table 1 for a tabular representation of the sample.

Table 1. Sample descriptive.

Subreddit	Total number of comments	Average comments per submission	Words per Posts
r/ADHD	17,853	7.141	27.649
r/AnorexiaNervosa	10,049	4.020	24.515
r/ShowerThoughts	13,386	5.354	11.108

Note: All subreddits were sampled for 2,500 submissions, with content posted from 1 January 2019 to 31 December 2019. Words per post given by both submissions and comments.

Empirical distributions of words

The frequency of each unique word was calculated for each online community. ADHD was the community with the highest total words (493,616) but the lowest prevalence of unique words in the sample (4.87%). Anorexia Nervosa, on the other hand, had a total of 246,348 words and an intermediate prevalence of unique words (6.29%) between ADHD and general content. General content, in fact, had the lowest number of total words (148,696) but the highest prevalence of unique words (10.21%). Moreover, a gradient in the goodness of fit for Zipf's law was observed. The community of peers with ADHD showed the worst goodness of fit (MAE 22.056; MSLE 3.633), Anorexia Nervosa an intermediate goodness of fit (MAE 18.872; MSLE 3.477), and the general community the best (MAE 10.658; MSLE 2.624).

Table 2. Frequency of unique words, empirical distributions.

Subreddit	Total words	Unique words	Z exponent	C constant	MAE	MSLE
r/ADHD	493,616	27,037 (4.87%)	1.260	4.169	22.056	3.633
r/AnorexiaNervosa	246,348	15,514 (6.29%)	1.241	4.336	18.872	3.477
r/ShowerThoughts	148,696	15,187 (10.21%)	1.055	8.027	10.658	2.624

Note: Prevalence of unique words is given by dividing unique words by total words.
MAE: Mean Absolute Error; MSLE: Mean Squared Log Error.

The Z exponent and C constant of Zipf's law were fit according to MLE for each written corpus. The most used words were less frequent than expected across all communities. However, a higher frequency of rare words (the right-hand side of the distribution) was observed only in communities of peers affected by ADHD or AN. The divergence from theoretical distribution (best fitted according to MLE as described above) interested words ranked 1000th or lower. The results can be found in Figure 1.

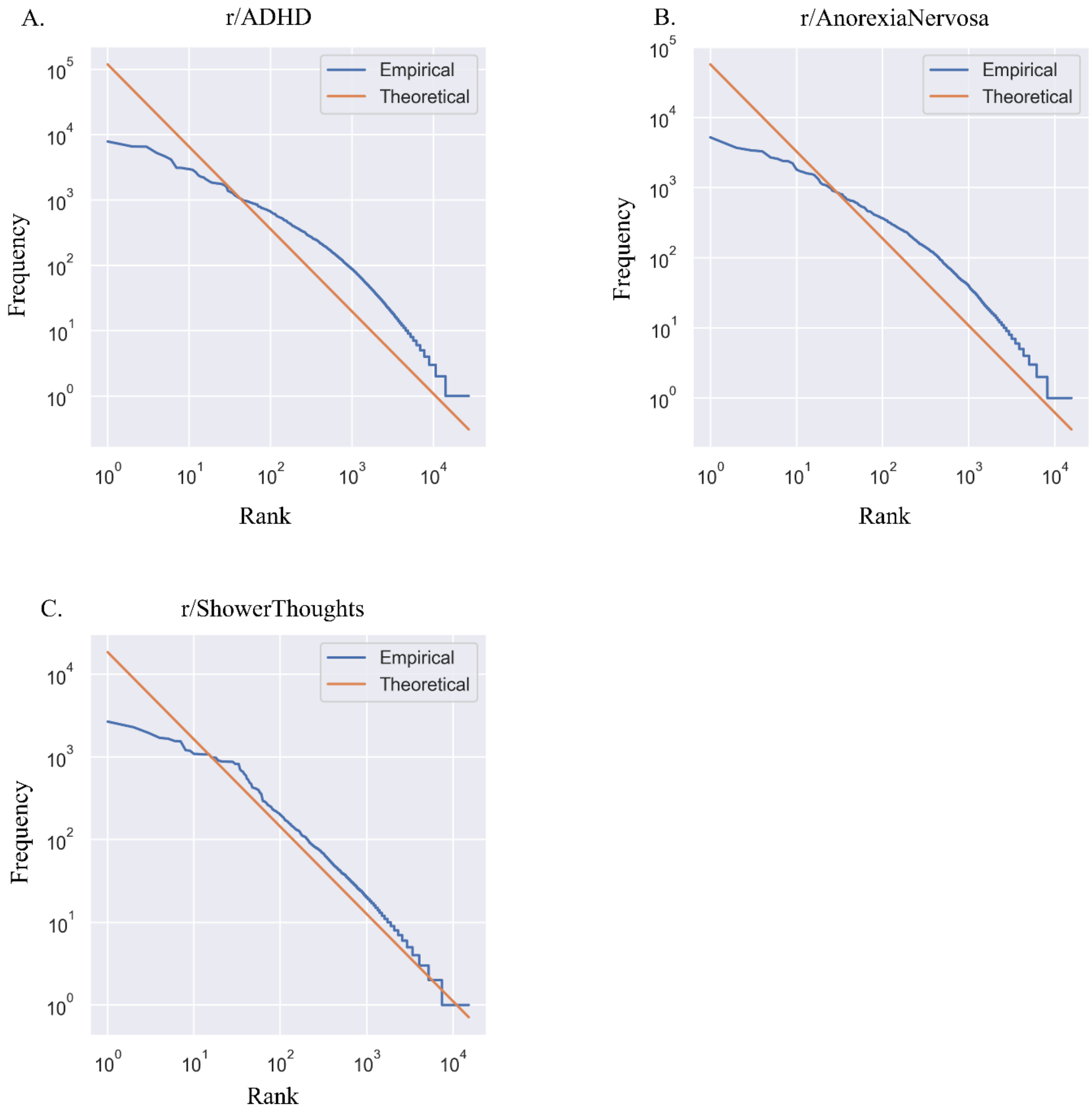

Figure 1. Relationship between frequency and rank of each word, theoretical and empirical distributions.

Most distinct words

The 10 most distinct words per community are represented in Table 3. Both the communities of peers affected by ADHD and AN were more distinctively represented by the words "time" and "people". The ADHD community was represented mainly by its specific term ("ADHD", TF-IDF 0.289), as the community of AN patients ("eating," TF-IDF 0.210, "eat", TF-IDF 0.195, "weight", TF-IDF 0.212). By contrast, the general community of r/ShowerThought was distinctively represented by words pertaining to the realm of etiquette and moderation in the community ("removed," "please", "frequently asked questions, FAQ," "rules," "moderators").

Table 3. Distinct word per community.

r/ADHD		r/AnorexiaNervosa		r/ShowerThoughts	
Word	**TF-IDF**	**Word**	**TF-IDF**	**Word**	**TF-IDF**
ADHD	0.289	Feel	0.236	Please	0.313
Get	0.259	Know	0.226	Removed	0.237
Time	0.206	Weight	0.212	FAQ	0.233
One	0.154	Eating	0.210	Rules	0.227
Really	0.152	Get	0.198	Reddit	0.224
Know	0.151	Eat	0.195	Wiki	0.208
Things	0.148	Really	0.165	Moderators	0.202
People	0.148	Want	0.158	Google	0.174
Feel	0.142	Time	0.146	Games	0.174
Work	0.132	People	0.144	Automatically	0.161

Note: TF-IDF: Text Frequency – Inverse Document Frequency.

DISCUSSION

The current study aimed to explore the linguistic patterns in online communities of peers affected by ADHD and Anorexia Nervosa (AN) using Zipf's law as a framework. Contrary to the working hypothesis, the findings indicated no overinflation of the most frequent words in both communities. Instead, a higher frequency of unique, less-used words was observed. This divergence from expected linguistic patterns under Zipf's law may reflect the unique communicative needs and experiences of individuals in these groups.

In the ADHD community, the prevalence of unique words could be linked to the diverse and idiosyncratic nature of the disorder [37]. ADHD's core symptoms, like inattention and hyperactivity, might lead to a broader, more varied lexical choice as individuals seek to articulate their distinct experiences and coping strategies. This is further supported by the presence of words like "ADHD," "time," and "people" among the most distinct words, highlighting the community's focus on personal experiences and social interactions.

Similarly, the AN community displayed a unique lexical pattern, potentially reflecting the complex emotional and physical experiences associated with eating disorders [38-40]. Words like "eating," "weight," and "eat" were prominent, indicating a focused discussion on specific aspects of the disorder. The high prevalence of unique words in this community might indicate the nuanced and personal nature of discussing and coping with AN and sharing diverse personal stories and recovery journeys [41,42].

The current descriptive analysis using Zipf's law revealed that the ADHD community had a lower prevalence of unique words compared to the AN community. Still, both deviated from the general content regarding word frequency distribution.

This suggests that while both communities tend towards lexical diversity, the nature and context of their discussions differ significantly.

The TF-IDF analysis further illuminated these differences, revealing the most distinct words in each community. This analysis provides a deeper understanding of each group's thematic focuses and linguistic peculiarities [43,44].

Future directions

The findings of this study open new avenues for future research. A deeper exploration into the psycholinguistic patterns of other neurodivergent communities could provide valuable insights into the unique ways these groups use language. Additionally, longitudinal studies could track changes in language use over time, particularly as members of these communities evolve in their understanding and experiences of their conditions.

Study limitations

This study, however, is not without limitations. Firstly, the clinical samples are divergent and lack an objective definition of psychopathology or confirmation of diagnosis. This raises questions about the generalizability of our findings to all individuals with ADHD or AN. Furthermore, relying on online written text may not fully capture the complexities of language use in these communities, as online communication can significantly differ from other forms of expression.

CONCLUSIONS

Contrary to the working hypothesis, neither of the two online communities of peers showed an overinflation of the most frequent words. By contrast, a higher frequency of unique, less-used words was observed in both. A divergence from the content retrieved by general communities was present in the online discourse of patients with ADHD and AN.

In conclusion, our study reveals intriguing linguistic patterns in online communities of peers affected by ADHD and AN, challenging the traditional understanding of Zipf's law in the context of neurodivergence. These findings underscore the importance of considering unique linguistic expressions in psychopathological research and highlight language use's rich, diverse nature in neurodivergent communities.

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Original Article in Public Health and Infectious Diseases

Prevention of tuberculosis transmission in the household: An investigation of knowledge, attitudes, and practices in West Halmahera Regency, Indonesia

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Abstract

Introduction: Emphasizing the significance of tuberculosis (TB) in the family environment is crucial due to the high rate of transmission among members of the household. This phenomenon has been proven by molecular epidemiological studies using fingerprint D.N.A. analysis to describe the easy transmission incidents in the family environment. Therefore, this study aimed to determine TB patients' knowledge, attitudes, and practices (KAP) in preventing transmission among family members in West Halmahera Regency, North Maluku Province, Indonesia.

Methods: This study was conducted using a cross-sectional design, including 150 TB patients as respondents selected through a sampling method. A structured questionnaire was used as an interview guide for face-to-face data collection. The analysis was conducted from January to June 2023, and the data obtained were analyzed using descriptive statistics with a frequency distribution table and supplemented by narrative.

Results: The results showed that 91 respondents (60.7%) had a good level of knowledge, 76 (50.7%) had favorable attitudes, and 81 (54.0%) had good practices in prevention of TB transmission. Although KAP was in a good category, there were still 43 respondents (28.7%) with TB patients in other family members.

Conclusions: The data obtained showed a possibility of TB transmission to other family members in the household due to a lack of KAP in prevention. Monitoring and patient access to pulmonary TB drugs was also found to be suboptimal. Consequently, proactive efforts are essential to enhance prevention in families to eliminate TB patients in line with the objectives stated in the national strategy for controlling TB in Indonesia.

Take-home message: A study of KAP in a community is useful for planning, implementing, and evaluating programs to eliminate TB patients. This indicates that KAP level testing can be used to determine follow-up methods for handling TB transmission in the family.

Keywords: incidence of transmission; Knowledge-Attitudes-Practices (KAP); transmission in family; tuberculosis.

INTRODUCTION

The infectious disease pulmonary tuberculosis (TB) is a global health burden with a significantly high incidence rate [1-3]. In Indonesia, the prevalence of this disease is excessively high, ranking second after India with a total of 969,000 cases or 354 per 100,000 population [2,4]. Currently, Indonesia, along with other countries, is also categorized as High Burden Countries for dealing with TB cases, TB with HIV, and Multi-Drug Resistance-TB (MDR-TB) [5,6]. To eliminate TB transmission, the country has developed a community-centered planning and program priority approach, as recommended by WHO. This strategy uses epidemiological evidence, focusing on community characteristics, such as the socio-economic characteristics of patients and family support [7]. Moreover, an essential strategy is to prevent transmission and reduce factors complicating TB infection, such as preventing the occurrence of MDR-TB [1,2].

Several reports showed that TB transmission easily occurred between family members or in the community [8-11]. Similarly, it was reported that, on average, one TB patient can infect 10 to 15 people [12]. This ease of transmission is attributed to TB being airborne and disseminating through droplets containing Mycobacterium tuberculosis bacteria. When an individual infected with TB coughs, sneezes, or talks, particles in the form of droplet nuclei can spread in the air and inhaled by those in proximity [13-16], posing a risk for human-to-human transmission. However, the prevention and treatment of this disease become increasingly difficult when transmission occurs from patients who have drug-resistant [17,18].

The management and control of TB face complexity due to the occurrence of drug resistance in patients, known as MDR-TB. This resistance makes the prescribed medication ineffective against Mycobacterium tuberculosis, complicating the treatment process. Resistance to TB drugs can occur due to incorrect diagnosis, improper treatment combination, irregular medication, inadequate medication types or dosage, and premature cessation of treatment [19,20]. In the presence of an MDR-TB in the family, other members are at risk of TB transmission and are resistant to drugs. Early diagnosis and immediate treatment of infected family members are essential to inhibit transmission [17].

Studies on knowledge, attitudes, and practices (KAP) in preventing TB transmission in family members are required to inhibit the spread. This is because actions based on KAP significantly contribute to the success of disease eradication, including achieving the End TB program. Consequently, this study aimed to assess KAP regarding the prevention of TB transmission in the family and the occurrence of MDR-TB. The results are expected to provide valuable information to determine the characteristics of the community, serving as a signal to raise awareness about the prevention of TB transmission.

Research about measuring the KAP level of TB patients in the work area of West Halmahera Regency Health Service is still limited, particularly in the Jailolo health center area. Based on annual data (2021-2022), there is a trend towards an increase in the number of pulmonary TB patients in the region. This shows the need for community-based research to determine KAP in preventing TB transmission among family members. Therefore, the data will be useful for developing community-based TB prevention programs, including developing effective health education.

METHODS

Study design and participants

This study was carried out from January to June 2023 using a cross-sectional design in the work area of West Halmahera Regency Health Service, North Maluku Province, Indonesia. Respondents were registered 150 pulmonary TB patients in the West Halmahera Regency area, selected through a total sampling method.

West Halmahera Regency is on Halmahera Island with an area of 1,074 Km2, having an estimated population of 137,126 people in 2022, or around 10.42% of the total population in North Maluku Province. Geographically, West Halmahera Regency is between 10°N-30°N and 1250°E-1280°E. The capital of West Halmahera Regency is Jailolo, and the distance to the provincial capital in Sofifi is 39 Km. Furthermore, this regency has one regional general hospital and 14 community health centers.

Statistical analysis

The data collected included socio-demographic information and several questions to measure KAP in the questionnaire. Subsequently, the questionnaire consisted of 5 questions about knowledge, 3 statements regarding attitudes, and 5 statements on practices to prevent TB transmission in the family. Knowledge assessment used the Guttman scale, while practices were assessed using a Likert scale.

Knowledge questions were related to preventing transmission incidents and treating TB. Respondents who selected the answer "right" were given a score of 1, and those who answered "wrong" and "don't know" were given a score of 0. Similarly, attitudes measurement also focused on preventing TB transmission and drug resistance. Respondents with an answer of "agree" were given a value of 1, and "disagree" was given a value of 0. Regarding TB prevention practices in the family, successive values were used, namely the answers "always=4", “often =3", "sometimes=2 ”, “seldom= 1”, and “never=0”. The median value calculation was used as a cut-off to determine the objective criteria for KAP value. The data was analyzed using descriptive statistics and accompanied by narratives to interpret the data.

Ethical aspects

The study was conducted in accordance with the Declaration of Helsinki and approved by the Faculty of Health Sciences, Universitas Muhammadiyah Maluku Utara (No. 94/A/R/XII/2022, December 12, 2022). Informed consent was obtained from all respondents before participation, and all respondents were given an explanation regarding this study and were assured of anonymity and confidentiality.

RESULTS

Respondents included in this study were active TB patients with an average age of 38 years, consisting of 3 and 78 years old, as the youngest and oldest, respectively. The largest age group was found to be 15-24 years old, comprising 35 (23.3%) respondents. Based on gender category, 91 (60.79%) respondents were men. As shown in Table 1, the 15-54-year age group was those in the productive working age, comprising 118 (78.66%) respondents as the largest category of TB patients. 138 (92.0%) respondents had the highest level of education in the low category, while 12 (8.0%) were in the high category. Moreover, the low category is included in the range of basic education to Junior High School, while high education ranges from High School to College.

Among 150 respondents, 115 (76.7%) had permanent jobs and 35 (23.3%) did not work. The most common jobs were farmers, plantation workers, and laborers. The results also showed that 128 (85.3%) respondents had TB drug monitoring status, and 22 (14.7%) did not. Regarding access to obtaining TB drugs, 103 (68.7%) respondents obtained drugs easily, while 47 (31.2%) experienced difficulty. The data presented in Table 1 also showed that 43 (28.7%) respondents had active TB patients in the household, and 11 (7.3%) reported suffering from other diseases.

Table 1. Socio-demographic characteristics of respondents in West Halmahera Regency (n=150).

Characteristics		Frequency	Percentage
Gender	Male	91	60.7
	Female	59	39.3
Age category (years)	<15	5	3.3
	15-24	35	23.3
	25-34	29	19.3
	35-44	28	18.7
	45-54	26	17.3
	55-64	16	10.7
	>65	11	7.3
Education	Low education	138	92.0
	High education	12	8.0
Occupation	Working	115	76.7
	Doesn't work	35	23.3
TB drugs monitoring status	Yes	128	85.3
	No	22	14.7
Other family members suffer from TB	Yes	43	28.7
	No	107	71.3
Suffering from other diseases	Yes	11	7.3
	No	139	92.7
Access to TB drug program	Easy	103	68.7
	Difficult	47	31.2

Regarding the knowledge measurement, 115 (76.6%) respondents were unaware that TB disease could be transmitted through droplets. However, a significant portion (82%) were aware that the duration of treatment for pulmonary TB with the drug was 6-8 months. Additionally, 76.7% of respondents showed awareness that failure to complete treatment could lead to a more severe TB infection. As shown in Table 2, 114 (76.0%) respondents were aware that TB transmission in the family could be prevented by sleeping separately from TB patients. However, 23 (15.3%) were unaware of preventing TB transmission, such as covering the mouth during coughing.

Table 2. Knowledge level about prevention of TB transmission in West Halmahera Regency (n= 150).

Knowledge questions		Frequency	Percentage
Patients with TB can transmit the disease they suffer from through droplets	Right	33	22.0
	Wrong	2	1.3
	Don't know	115	76.7
The regimen/duration of TB treatment using TB	Right	123	82.0

drug is 6-8 months	Wrong	2	1.3
	Don't know	25	16.7
Failure to complete the treatment regimen can lead to more severe TB infection	Right	115	76.7
	Wrong	1	0.7
	Don't know	34	22.6
Prevention of TB transmission can be by sleeping separately with other family members	Right	114	76.0
	Wrong	9	6.0
	Don't know	27	18.0
Prevention of TB transmission can be done by covering the mouth with a hand, cloth, or mask when a TB patient coughs	Right	124	82.7
	Wrong	3	2.0
	Don't know	23	15.3

Table 3 describes the attitudes of 86.7% of TB patients who agreed that transmission easily occurred in the family. Positive attitudes were observed toward the regularity of taking TB medication and awareness, as 84.7% agreed that irregular medication intake could lead to TB drugs. However, 82 (54.7%) respondents disagreed with long-term TB medication.

Table 3. Statement of attitude towards prevention of TB transmission in West Halmahera Regency (n=150).

Attitudes statements		**Frequency**	**Percentage**
I agree that TB transmission easily runs in families	Agree	130	86.7
	Disagree	20	13.3
When I do not take TB drugs regularly, I will become resistant to TB drugs later in life	Agree	127	84.7
	Disagree	23	15.3
I agree to take TB medicine regularly even though I have to take it for a long time	Agree	68	45.3
	Disagree	82	54.7

Based on Table 4, only a small percentage of TB patients have practiced preventing transmission by regular treatment or covering the mouth when coughing. This is evident from responses that answered "always".

Table 4. Statements of practice in the prevention of TB transmission in West Halmahera Regency (n=150).

Practice statements		**Frequency**	**Percentage**
How often do you take TB medication regularly?	Always	19	12.7
	Often	57	38.0
	Sometimes	44	29.3
	Seldom	21	14.0
	Never	9	6.0
How often do you cover your mouth when coughing?	Always	39	26.0
	Often	47	31.3
	Sometimes	40	26.7
	Seldom	21	14.0
	Never	3	2.0

How often do you visit a health facility to check your health condition?	Always	7	4.7
	Often	47	31.3
	Sometimes	48	32.0
	Seldom	39	26.0
	Never	9	6.0
How often do other family members have their health checked?	Always	8	5.3
	Often	21	14.0
	Sometimes	89	59.3
	Seldom	26	17.3
	Never	6	4.0
How often do you have a disturbing reaction to TB drugs but continue to take medication?	Always	16	10.7
	Often	40	26.7
	Sometimes	29	19.3
	Seldom	18	12.0
	Never	47	31.3

A total of 91 (60.7%) respondents had good knowledge of the prevention of TB transmission, while 59 (39.3%) showed less awareness. Respondents who had good attitudes were 76 (50.7%), while 74 (49.3%) showed poor attitudes. Furthermore, 81 (54.0%) respondents had good practices, while 69 (46.0%) had poor practices (Table 5).

Table 5. Summary of KAP for prevention of TB transmission in West Halmahera Regency (n=150).

Variables	**Category**	**n**	**%**
Knowledge	Good knowledge	91	60.7
	Poor knowledge	59	39.3
Total		150	100
Attitudes	Favorable attitudes	76	50.7
	Unfavorable attitudes	74	49.3
Total		150	100
Practices	Good practices	81	54.0
	Poor practices	69	46.0
Total		150	100

DISCUSSION

This study was conducted to determine the socio-demographic conditions and KAP levels of active TB patients in West Halmahera Regency. The analysis is crucial to obtain valuable data in preparing and evaluating TB eradication programs, serving as a warning against transmission. Good KAP is expected to be a strategy for solving the problem of TB transmission and reducing stigma in treatment [21,22]. However, an obstacle to eradicating TB in Indonesia is the gap in control, partly attributed to delayed initiation of treatment for diagnosed cases. The results of the 2013-2014 TB prevalence survey in the country showed that 43% of the population with TB symptoms did not seek treatment, and 31% sought treatment independently. This significant discrepancy is attributed to insufficient public knowledge about TB [23]. Moreover, delaying examination and treatment can increase morbidity and mortality [21], hindering the reduction in the number of TB patients.

Based on this study, most TB patients are men (60.7%). In local community tradition, men are often responsible for the family, significantly impacting the family's income. Furthermore, men tend to engage in smoking, which is a risk factor for TB incidence. This is because smoking increases the risk of infection when exposed to Mycobacterium tuberculosis, elevating the risk of developing active TB [24,25]. The results also showed that 118 (78.66%) TB patients were of productive or working age. The working age group suffering from an illness can cause low income for their families, affecting the ability to maintain health, education, knowledge, food intake, nutritional status, treatment of diseases, and living conditions. According to previous investigations [26], low income is at risk of suffering from pulmonary TB 4.4 times compared to high income in the working area of Sempor 1 Health Center, Kebumen Regency, Indonesia. Another study reported that approximately 95% of deaths due to TB were in countries with middle and low income [27].

A total of 115 (76.7%) respondents in this study were unaware that TB transmission could be through droplets. Moreover, droplets are splashes of phlegm or sputum released when coughing, sneezing, talking, or even singing, containing Mycobacterium tuberculosis, which individuals can inhale in close proximity [13-16]. A previous study [28] also reported that knowledge about TB prevention and transmission in the Equatorial Guinea community was still lacking [28] and in the Saudi Arabian community [29]. Studies in other regions in Indonesia, namely Bulungan Regency and North Kalimantan Province, obtained data on the knowledge of prevention of TB transmission in families of TB patients in the good category [30].

This study measured knowledge of TB prevention, including the correct length of treatment, awareness of the severe impact of treatment failure or drug withdrawal, and preventive measures in family members, such as sleeping separately from patients and covering the mouth during coughing or sneezing. Although the results showed that most respondents are aware of the prevention of TB transmission in the family, the knowledge is still lacking among others, as shown in Table 2. This showed that continuous socialization and education must be provided to both patients and family members.

Global challenges in preventing TB transmission persist across countries, including those with a low incidence rate, such as Oman [31] and Norway [32]. This persistence is attributed to the health behavior of the general population. One of the factors influencing health behavior is good attitudes towards the information received [33]. In this study, attitudes toward the prevention of TB transmission were measured with three statements, as shown in Table 3. The majority of respondents showed positive attitudes toward the prevention of TB transmission.

Meanwhile, in the third statement, namely, the respondent's willingness to take TB medication regularly as a long-term treatment, 82% disagreed. This result should be of concern as irregular and incomplete TB treatment can trigger drug resistance, a significant challenge in global elimination efforts [34]. Similarly, research conducted at a hospital in southwestern Ethiopia reported that attitudes toward preventing TB transmission were almost comparable between patients with favorable and unfavorable attitudes. This shows that individual attitudes are crucial in controlling TB transmission [35]. A report in other regions in Ethiopia also showed that the level of attitudes towards TB prevention was more in the favorable category [36].

TB prevention practices showed a good category among 54% of respondents, as shown in Table 5. Moreover, five statements regarding TB prevention practices, including regular TB treatment and not stopping medication, covering the mouth when coughing or sneezing, and having health checks for all family members regularly, show that only a small percentage of respondents always implement these practices. This percentage is considered insufficient because transmission prevention practices must be carried out strictly due to the threat of resistance to Mycobacterium tuberculosis, which can complicate further treatment [16,37]. Similarly, a previous study in Ethiopia [35,36] showed that TB prevention practices were still low.

The occurrence of drug resistance, specifically MDR-TB, poses a significant challenge to TB treatment and breaking the chain of transmission [34]. MDR-TB is characterized by resistance to at least rifampicin and isoniazid [37-40] due to poor quality of treatment, inappropriate drug dosage, and non-compliance to treatment completion [34,40]. Therefore, TB transmission prevention programs require community participation, determined by good community KAP [30], to facilitate TB elimination. The strategies for increasing KAP for TB prevention and transmission include effective educational programs that provide health education strategies. This consists of delivering basic information about signs/symptoms of TB to individuals or groups, shortening the diagnosis, and delaying treatment to reduce the transmission rate [35].

Furthermore, efforts should be made to implement health education and increase awareness of TB patients about MDR-TB [39]. Based on the gaps identified, this study suggests some recommendations to the concerned authorities. Mecha Regency Health office is recommended to strengthen the awareness creation and health education program towards TB in each healthcare facility. Other responsible stakeholders and NGOs are also recommended to launch awareness sessions about the impact of poor TB practices on the health and the community [36]. Health authorities should intensify efforts and organize specific educational programs about the disease and its impact on the spread of infection in large population sectors. Regarding discovery, treatment should be given special attention by government medical authorities [29], including community-based TB transmission prevention [13].

Studies have proven that TB transmission could occur at the household level and in the community based on fingerprint DNA evidence [8,9,13]. Moreover, with estimates suggesting that one TB patient can infect approximately 10-15 individuals [12], and easy transmission of MDR-TB [41], the provision of early diagnosis is essential for adequate treatment and immediate spread break. Identifying risk factors for TB transmission can also prevent the development of latent TB infection into active disease [41].

CONCLUSIONS

In conclusion, this study showed the ease of TB transmission in the household. The results showed that patients and other family members should be adequately aware of preventive measures. A crucial aspect of this effort was found to be increasing KAP in the prevention of transmission. Furthermore, TB prevention practices included proper monitoring of adherence to medication for adequate recovery through the availability of access to TB drugs. By implementing these measures, the high incidence rate of MDR-TB, a significant challenge faced in TB treatment, could be prevented.

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Advances in Medicine, Psychology and Public Health (AMPPH)

Case Report in Internal Medicine

An infrequent but unpleasant adverse event of Tamsulosin

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Abstract

Tamsulosin, a selective α1-adrenoceptor antagonist, is primarily approved for managing benign prostatic hyperplasia. Its off-label application in facilitating the spontaneous passage of ureteral stones, particularly in cases of renal colic, has gained traction in recent years.

This report details a rare adverse effect of Tamsulosin observed in a young woman who was concurrently receiving atenolol for primary hypertension and was prescribed Tamsulosin following an episode of renal colic. Remarkably, after three doses, she developed severe constipation, a condition that necessitated manual interventions for resolution. Upon discontinuing Tamsulosin, her bowel function normalized. Given the localization of α1-adrenoceptors in the smooth muscles of intestinal sphincters, it is postulated that Tamsulosin's action, potentially compounded by atenolol's effects, contributed to this adverse reaction.

This case underscores the importance of cautious prescribing and monitoring when utilizing Tamsulosin in contexts outside its primary indication. It highlights the intricate interplay between pharmacodynamics and individual patient factors in clinical settings.

Take-home message: Constipation can be an unusual but unpleasant adverse event of Tamsulosin.

Keywords: α1-adrenergic receptor; atenolol; adverse event; constipation; Tamsulosin.

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INTRODUCTION

Tamsulosin is an α1-adrenoceptor antagonist that has great selectivity for α1 receptors. Tamsulosin was approved by the Food and Drug Administration in 1997 for the treatment of the signs and symptoms of benign prostatic hyperplasia [1].

Although Tamsulosin is indicated for the signs and symptoms of prostatic benign hyperplasia, it has been evaluated in clinical studies for the potential treatment of other urinary conditions. Results of two systematic reviews showed that Tamsulosin increased the rate of spontaneous passage of ureteral stones in children and adults [2,3]. Off-label use of Tamsulosin has emerged in different populations, including conditions other than benign prostatic hyperplasia [4-6].

During the last 2 decades, the safety of Tamsulosin in the treatment of male urinary symptoms due to benign prostatic hyperplasia has been well established, and a recent review focused on the safety of other populations, such as women and children [7].

We report a case of an infrequent adverse effect of Tamsulosin in a young woman treated for renal colic.

CASE DESCRIPTION

A young woman with a history of primary hypertension, under management with atenolol, presented with an episode of renal colic. Her lifestyle factors, including diet and exercise routines, and a comprehensive medication history were evaluated to understand potential contributory factors to her condition.

The patient experienced acute renal colic. Renal echography confirmed a small stone in the ureteral tract. Given her symptoms and the stone's size, Tamsulosin was initiated as an off-label treatment to facilitate stone passage after considering alternative therapeutic options and the patient's specific medical history.

Following three doses of Tamsulosin, the patient reported severe constipation, accompanied by a sensation of perineal heaviness and difficulty in defecation. This symptom onset was notably acute, aligning closely with the initiation of Tamsulosin therapy.

Comprehensive abdominal imaging and blood tests were conducted to exclude other potential causes of constipation, which yielded no additional findings. Consultations with gastroenterology ruled out primary gastrointestinal disorders.

The patient's severe constipation necessitated two manual evacuations. Upon suspending Tamsulosin, a gradual return to normal bowel function was observed. This temporal relationship underscored the likelihood of Tamsulosin, potentially in combination with atenolol, as the key contributor to her symptoms.

Regular follow-ups post-Tamsulosin discontinuation showed complete resolution of constipation without recurrence. The patient's renal colic was subsequently managed with alternative conservative measures, including hydration and pain management, leading to spontaneous stone passage.

DISCUSSION

Although Tamsulosin is indicated for the signs and symptoms of benign prostatic hyperplasia, it has been evaluated for the potential treatment of other urinary conditions. In recent years, off-label use of Tamsulosin has emerged for treating renal colic to promote the spontaneous passage of ureteral stones [4].

Tamsulosin is an α1-adrenoceptor antagonist; the α1 receptors are mainly located in the smooth muscles of the bronchi and blood vessels, the sphincters, and the radial muscles of the iris. They are important in regulating and controlling the functions of the cardiovascular system, the genitourinary tract, and the gastrointestinal tract due to their presence in the walls and sphincters of the intestine.

Studies in patients treated with Tamsulosin reported some adverse effects, among which constipation, though with a marginal rate [5-9].

Moreover, atenolol is a cardioselective antagonist of β1 receptor. Still, it has been reported to have little activity against the β2 adrenergic receptor, mainly located in the bronchial and gastrointestinal smooth muscles [10].

The mechanism of defecation is a process dependent on the coordination and integration of multiple physiological systems, and it is suggestive that, in our case, the activity of Tamsulosin (perhaps in association with atenolol) may have led to the onset of constipation.

Implications for clinical practice

This case illustrates the significance of considering individual patient histories and the potential for unusual drug reactions, especially in off-label scenarios. It also highlights the need for clinicians to educate patients on possible side effects and closely monitor their response, particularly when prescribing medications like Tamsulosin with known broad receptor activity.

This revised case description offers a comprehensive view of the clinical scenario by providing a more detailed account of the patient's background, symptom progression, diagnostic evaluations, and follow-up. It underscores the complexities of managing atypical presentations and the importance of personalized treatment approaches.

CONCLUSIONS

This case report presents a rare but notable adverse effect of Tamsulosin, an α1-adrenoceptor antagonist, in a young woman treated for renal colic. While Tamsulosin is widely used and generally deemed safe, this case underscores the critical importance of clinical vigilance in monitoring adverse effects, particularly in populations not typically associated with its primary indication. The observed severe constipation, likely exacerbated by the concurrent use of atenolol, highlights the complexity of drug interactions and the variable expression of receptor activity in different tissues. This report contributes to the growing body of literature on the side effects of Tamsulosin, especially in off-label uses, and underscores the need for personalized patient care approaches, taking into account individual medical histories and concurrent medications.

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